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INTRODUCTION

The City of Raleigh Public Utilities Department has prepared this Handbook to summarize the policies, standards, and specifications of the Department in one document. The Public Utilities Department has the responsibility for operating, maintaining and expanding the water, sewer, and reuse systems of the City of Raleigh. The City Charter gives the City Council the authority to create a Public Utilities Department and further states that the Public Utilities Department will be self-sustaining through its water and sewer rates and other fees. The City Code goes into the detail of describing the duties, functions, and policies of the Public Utilities Department.

The City of Raleigh provides water and sewer service to over 125,000 retail customers in Raleigh, Garner, Wake Forest, and Rolesville areas. The City is also developing its reuse water system to provide an alternative water resource for demands not requiring potable water quality. In addition to the retail customers, there are also 5 wholesale customers that buy water in bulk from the City. The wholesale customers are the towns of Knightdale, Holly Springs, Zebulon, Wendell, and Fuquay Varina. Falls Lake is the drinking water supply for the City with a capacity of 100 million gallons per day (mgd) allocated for drinking water. The City of Raleigh is the sole entity that is permitted to use Falls Lake water for drinking water.

The Falls Lake was completed in 1983 by the United States government. The US Corps of Army Engineers manages the lake and the State of North Carolina manages the recreational facilities on the lake.

The City of Raleigh E.M. Johnson Water Treatment Plant (WTP) is located at 10301 Falls of the Neuse Road. The WTP has a capacity of 86 mgd and averages 50.71 mgd year-round.

The Neuse River Wastewater Treatment Plant (WWTP) is located on 8500 Battle Bridge Road. The WWTP has a capacity of 60 mgd and processes an average of 42 mgd of wastewater year-round. At the WWTP, the Public Utilities Department has several marketable products, such as soybeans, lime stabilized sludge as a soil amendment, and reuse water for irrigation water and other non-potable uses.

The utility system is also supported by the Public Utilities Operations Center located at 3304 Lake Woodard Drive. The Operations Center provides the meter reading, maintenance, construction, and warehouse functions for the Department. There are over 1,350 miles of water main and 1,600 miles of sewer main between 2 and 72 inches and 42,000 manholes to be maintained by the City.

The Administrative office for the Public Utilities Department is located in Suite 620 of the One Exchange Plaza Building at 219 Fayetteville St. Mall. The staff in the Administrative offices will assist in the map location of the existing water, sewer, and reuse mains, assist with questions regarding water, sewer, and reuse extension policies, and be able to show the locations for what is planned. Copies of the existing water, sewer, and reuse system maps may be purchased (prices vary depending on size of map) from this office. The phone number for the Administrative Office is (919) 857-4540.

This Handbook is designed to facilitate understanding by developers, engineers, contractors, and the citizens in general of how the City Public Utilities Department does business both inside the City limits and in the City's extraterritorial jurisdiction. **This handbook is not intended to replace the Charter, Code, or standards**, but to group the various information on policy, design, material, construction, and standard detail drawings used by the Public Utilities Department into one reference source. The contents of this book are subject to change at any time, without notice.

The organization of this material falls into four primary areas, General Policies/Regulations, Water, Sewer, and Reuse. The water, sewer, and reuse sections will each cover the respective design, materials, construction, and standard details for that utility.

Much of the information covered in this book has been adopted from other sources such as State and National Standards and Regulations, "good engineering practice", and the experience of the staffs of the City of Raleigh Public Utilities and Public Works Departments. **The standards, policies, and specifications indicated in this book shall be considered final and exceptions may only be granted by the Public Utilities Director upon written request PRIOR to construction.**

DEFINITIONS

Throughout this Handbook, the following terms shall have the meanings ascribed to them respectively:

Air-gap separation: An unobstructed vertical distance through the atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or other device and the flood level rim of the receptacle. An approved air-gap vertical separation shall be at least double the diameter of the supply pipe. In no case shall the air-gap be less than one (1) inch.

Approved: Certified in writing by the Director of Public Utilities as an acceptable device or methodology used within the City of Raleigh Public Utilities System.

Auxiliary intake: Any piping connection or other device whereby water may be secured from a source other than public water supply.

Backflow: Any flow of water into the public water supply from any other source due to a cross-connection, auxiliary intake, interconnection, backpressure, backsiphonage, any combination thereof, or other cause.

Backpressure: Any pressure on any source of water other than the public water supply which may be greater than the pressure on the public water supply and may result in a backflow.

Backflow prevention device: An approved effective device or method used to prevent backflow from occurring in the potable water supply. The type of device required shall be based on degree of hazard, existing or potential.

Backsiphonage: Any circumstance in which the pressure on the public water supply may be reduced to the point that the elevation and atmospheric pressure on a source of water other than the public water supply may result in a pressure to be greater than the pressure on the public water supply and may result in a backflow.

Certified tester: A person who has proven his/her competency to test, repair, overhaul and make reports on backflow prevention devices as evidenced by certification of successful completion of a training program approved by the Director of Public Utilities.

Confinement assembly or device: A backflow prevention device, as approved and required, installed within a private plumbing or distribution system to isolate a localized hazard from the remainder of said system.

Containment device: A backflow prevention device, as approved and required, installed at the point of separation between the public water supply and a private service or private distribution system or at the point of metering.

Cross-connection: Any physical connection whereby the public water supply is connected with any other water supply system, whether public or private, either inside or outside of any building or buildings, in such a manner that a flow of water into the public water supply is possible either through the manipulation of valves or because of ineffective check or back-pressure valves, or because of any other arrangement.

Cross-connection control coordinator: The official position established and authorized by the City and designated by the Director of Public Utilities to administer and interpret the cross connection section of these specifications and who shall also be a certified tester.

Double check valve backflow prevention device: An approved assembly composed of two (2) single, spring-loaded independently operating check valves, including tightly closing shut-off valves located at each end of the assembly, and having suitable connections for testing the watertightness of each check valve.

Dual check valve: An approved device containing two (2) independently acting check valves in series.

Fire line: A system of pipes and equipment used to supply water in an emergency for extinguishing fire.

Food preparation facility or establishment: Any commercial or industrial facility that prepares or serves food, including a restaurant, cafe, cafeteria, snack bar, grill, deli, catering service, bakery, grocery store, butcher shop, or similar establishment.

Indirect discharge or discharge: The discharge or the introduction from any non-domestic source regulated under §307(b), (c), or (d) of the Act (33 U.S.C. 1317), into the POTW (including holding tank waste discharged into the system).

Interconnection: Any system of piping or other arrangement whereby the public water supply is connected directly with a sewer, drain, conduit, pool, heat exchanger, storage reservoir, or other device which does or may contain sewage or other waste or substance which would be capable of imparting contamination to the public water supply.

Interference: The inhibition or disruption of the POTW treatment processes, operations, or its sludge process, use, or disposal, which causes or contributes to a violation of any requirement of the POTW's NPDES or Nondischarge Permit or prevents sewage sludge use or disposal in compliance with specified applicable state and Federal statutes, regulations or permits. The term includes prevention of sewage sludge use or disposal by the POTW in accordance with §405 of the Act (33 U.S.C. 1345) or any criteria, guidelines, or regulations developed pursuant to the Solid Waste Disposal Act (SWDA) (42 U.S.C. 6901, et seq.), the Clean Air Act, the Toxic Substances Control Act, the Marine Protection Research and Sanctuary Act (MPRSA) or more stringent state criteria (including those contained in any state sludge management plan prepared pursuant to Title IV of SWDA) applicable to the method of disposal or use employed by the POTW.

Major utility mains: Those water, reuse water, and/or sewer lines which are twelve (12) inches in diameter or greater.

Person: Any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity or any other legal entity, or their legal representatives, agents or assigns. This definition includes all Federal, state, and local government entities.

Publicly-owned treatment works (POTW) or municipal waste water system: A treatment works as defined by §212 of the Act (33 U.S.C. 1292) which is owned in this instance by the City. This definition includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes, and other conveyances only if they convey waste water to the POTW treatment plant. For the purposes of this Handbook, POTW shall also include any sewers that convey waste waters to the POTW from persons outside the City who are, by contract or agreement with the City, or in any other way, users of the City's POTW.

Pressure vacuum breaker: An approved assembly containing an independently operating spring loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve. The assembly must be equipped with suitable connections for testing the proper operation of the device and tightly closing shut-off valves located at each end of the assembly.

Pretreatment or treatment: The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in waste water prior to or in lieu of discharging or otherwise introducing such pollution into a POTW. The reduction or alteration can be obtained by physical, chemical or biological processes, or process changes or other means, except by diluting the concentration of the pollutants unless allowed by an applicable pretreatment standard.

Public water supply or system: The water and waterworks system of the City of Raleigh, and its customers outside the corporate limits, for general use and which supply is recognized as the public water supply by the North Carolina Department of Environment and Natural Resources.

Reduced pressure zone principle backflow prevention device (RPZ) : An approved device containing within its structure two (2) spring loaded independently operating check valves, together with an automatically operating pressure differential relief valve located between the two (2) check valves. The first check valve reduces the supply pressure a predetermined amount so that during normal flow and at cessation of normal flow the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the check valves less than the supply pressure. This device shall have suitable connections for testing the proper operation of the device, including tightly closing shut-off valves located at each end of the device.

Reuse water: Wastewater that has been treated to water quality standards as defined by the applicable section of the North Carolina Administrative Code and is intended to be distributed for non potable uses such as irrigation and/or industrial processes.

Reuse water service stubs: Those portions of the reuse water service pipes that connect to the City's reuse water mains and extend to the boundaries of public easements and rights-of-way.

Sewer Interceptor/Outfall: Gravity sewer mains equal to or larger than 12" in size.

Stormwater: Any flow occurring during or following any form of natural precipitation and resulting therefrom.

Superintendent: The person designated by the City to supervise the operation of the publicly-owned treatment works and who is charged with certain duties and responsibilities by the City Code, or his duly authorized representative.

Tap size: The nominal diameter of the connection of a water or reuse line installed between a meter assembly and main connected to the water or reuse utility system of Raleigh, without regard to the configuration of that water or reuse assembly, or ownership of the water or reuse meter assembly, service, or water or reuse main.

Utility system, utility lines: Water pipelines, reuse water pipelines, and sewer pipelines (any or all as determined by the context), and shall include all pipes, valves, valve boxes, hydrants, and other fixtures, equipment, and apparatus connected to and forming a part of the main water, main reuse water, or sewer pipelines and systems or all, and all appliances necessary and convenient thereto. The utility lines dedicated to the City shall include only main distribution lines, valves, hydrants and other apparatus, fixtures and equipment forming a part of the lines laid in public streets, roads, highways and alleys or across City utility or sanitary sewer easements on private property, and shall not include lines leading from mains to building connections on private property and shall not include the water, reuse water, or sewer lines within any residences or other privately-owned

building. Utility lines built in accordance with City/County contract dated January, 1985, are part of the City's utility system.

Vehicle maintenance facility: Any commercial or industrial facility where automobiles, trucks, or equipment are serviced or maintained, including garages, service stations, repair shops, oil and lubrication shops, or similar establishments.

Wastewater: The liquid and water-carried industrial or domestic wastes from dwellings, commercial buildings, industrial facilities, mobile sources, treatment facilities and institutions, together with any groundwater, surface water, and stormwater that may be present, whether treated or untreated, which are contributed into or permitted to enter the POTW.

Water service stubs and (building sewer) sewer service stubs: Those portions of the water service and building sewer pipes which connect to the City's water and sewer mains and extend to the boundaries of public easements and rights-of-way.

GENERAL POLICIES/REGULATIONS

The City of Raleigh shall control and schedule the availability of water, sewer, and reuse services to its customers. Applications for permanent water, sewer, and reuse service connection are available at the Inspections Department Permit Office, 4th floor, Raleigh Municipal Building, 222 West Hargett Street, (919) 890-3450. Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.

Water and reuse service shall be provided on an as-available basis to the customer's meter. All customers shall hold the City not responsible from any and all claims, damages, liabilities, or expenses caused in whole or in part by pressure conditions, water quality variation, or interruptions in service. The customer shall be responsible for installation of booster pumps to increase pressure when necessary.

All water, sewer, and reuse main extensions and service connections to the City's water, sewer, and reuse systems must be approved, prior to construction, by the Public Utilities Department. All water and sewer main extensions outside the corporate limits must be approved by the City Council. The minimum size water main is six inches for single family residential areas, however four-inch water mains will be allowed under certain conditions. All other land uses shall have an eight-inch main as the minimum size for water. The minimum sanitary sewer main shall be eight inches in all areas. The minimum size reuse main is four inches unless dictated otherwise by sound engineering and approved by the Public Utilities Department prior to construction.

All water, sewer, and reuse services in public rights-of-way are to be installed by the City or by a licensed utility contractor. Sewer services in easements will either be made by licensed utility contractors or licensed plumbers. All water, sewer, and reuse services in new subdivisions are the responsibility of the developer. To qualify for service, the total property frontage must abut a water main, sewer main, and/or reuse main. All potable and reuse water services will be metered, and the meter will be located at the right-of-way or in a 2-foot dedicated utility easement adjacent to the right-of-way. Additional connections and meters are allowed, along with common (master) meters and services as defined in Section 10-2002, where applicable, of the City Code. The City of Raleigh does not allow submetering for purposes of charging for more than the City rate for water, sewer, and reuse.

PUBLIC WATER, SEWER, AND REUSE EXTENSION POLICIES

To reimburse major utility mains, acreage fees will be charged to all property owners inside or outside the City for connecting to the City's water and sewer systems. This fee will be collected at the time of building permit application for new construction or at the time of the connection for existing buildings. The general exception for acreage fees is for property owners whose service was available prior to June 1, 1959 as confirmed by the City.

EXISTING LOTS - INSIDE CITY

Utility main extensions and replacements inside the corporate limits and constructed by the City, or by the City's contractor, will be made by assessment to the property owners who benefit from the improvements. As mentioned above, the standard size mains are four-inch, six-inch, and eight-inch for reuse, water, and sewer mains, respectively. If larger size mains are necessary, then the differential cost for larger size mains permitted by City standards will be paid for by the City. For corner and dual frontage lots, the property owner will receive a 150-foot exemption as follows:

- a. If water, sewer, and/or reuse mains are installed simultaneously in both streets on which a lot abuts, assessment of the costs of the installation shall be based upon the entire frontage of one street (short side) plus the frontage of the other street in excess of 150-feet.
- b. If a lot is already served by water, sewer and/or reuse that meet all City standards on one abutting street, any installation of the same service(s) on an abutting street will not be assessed for an existing residential-zoned single family house.

The 150-foot exemption for the corner lot will not apply when the abutting property is served by facilities less than the standard size mains. In this case, the installation on the abutting street will be assessed against the property. Along with the corner lot exemption, there is a 150-foot exemption for duplicating service when standard size or larger mains are existing in the street right-of-way and an additional main is installed. In order for these exemptions on corner lots and duplicating services to apply, the existing mains must have been assessed against the property or were installed by a developer without charge to the City.

EXISTING LOTS – OUTSIDE CITY

A charge in lieu of assessment will be made when the water, sewer, and/or reuse mains are located outside the corporate limits and were paid for by the City. A fee equal to the assessed cost of the mains will be collected from the property owner connecting. A charge in lieu of assessment must be paid prior to ownership transfer or at the time of property subdivision.

In addition to the charge in lieu of assessment, all other fees for water and/or sewer connections still apply.

The property owner must submit a petition for annexation to be eligible to connect to either water and/or sewer.

NEW DEVELOPMENTS

All standard size mains and services in new subdivisions shall be installed by the developers. Outside the City limits, the developer must have the City Council approval to extend the utility lines to the development, and this extension will be

done at no cost to the City. If the subdivision is outside the corporate limits, and water, sewer, and/or reuse are available, or will be available within twelve months after recording the plat, the developer shall connect to the City's utility system. For subdivisions outside the corporate limits, but inside the extraterritorial jurisdiction, the extensions of utilities beyond the corporate limits must be approved by the City Council. Those utilities less than 12 inches in size located outside the corporate limits will be paid for by the developer and are not reimbursable. It will be the developer's responsibility to acquire any necessary easements for the extensions. These easements must have functional access to public right of way and be properly recorded. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval. The recording procedure is outlined in the City of Raleigh Public Utilities Department Standard Procedure 602-4 (see Section F).

Details of the extensions and appropriate reimbursement procedures will be described below. The extensions must serve the total tract of land and meet all City requirements.

Inside the City limits, the City will be responsible for extending the facilities, or reimburse the developer for extending mains to the property provided City reimbursement policy is followed. If the proposed subdivision is inside the corporate limits, or if it is agreed that the area will be annexed, and over-sized mains are installed, then the City will pay the cost differential between a 6-inch and 8-inch main for water, between an 8-inch and 10-inch main for sewer, and between a 4-inch and 6-inch for reuse, provided that the extra size is not needed to serve that particular development. So that these costs can be reimbursed, the plans and specifications must be approved by the Public Utilities Director, and the developer must advertise for sealed bids. The bids will be opened at the Municipal Building with the lowest responsible bidder receiving the contract. The Chief Engineer will be given periodic estimates of the work completed and other information so that the actual cost of construction can be calculated. After completion of the work, the developer shall furnish the Chief Engineer an itemized list of the costs to be reimbursed. The details of this reimbursement procedure are fully described in the City of Raleigh Public Utilities Department Standard Procedure 700-6 (see Section F).

Once the mains have been installed, the individual service connections can be made. Below, two procedures are listed, with one being for service connections on existing mains and the other with the developer making the extensions and the service connections.

The procedure for water, sewer, and/or reuse service connections to existing mains, is outlined below:

1. The owner shall complete an application form and submit it to the Inspections Department along with the property identification.
2. The Inspections Department collects the appropriate fees prior to the issuance of the utility permit, and then installation may occur.

The procedure for connecting to water, sewer, and/or reuse facilities that must be extended for new developments within the City of Raleigh planning area is listed below. Procedures for the Towns of Garner, Wake Forest, and Rolesville can be obtained by contacting the respective Town planning department.

1. The applicant must have plans prepared by a registered engineer showing the water, sewer, and/or reuse lines necessary to serve the property.
2. The applicant must submit the plans, application form, and plats to the Planning Department for City approval.
3. After City Council approval, the Planning Department shall notify the applicant.
4. Tracings for the extensions shall be submitted to Public Works Department for City routing and approval.
5. Once the applicant has received the approved plans, they must provide 10 sets back to the City within 10 working days and the installation of the mains may proceed.
6. The charges for connections to the mains will be determined and collected by the Inspections Department. The individual service connections will be made by the developer's contractor.
7. Projects that have not begun construction after 1 year of receiving approved permitted plans are subject to new standards.

CITY ACCEPTANCE OF PRIVATE UTILITY SYSTEMS

Any existing private utility system desiring to make connection to the City of Raleigh system will submit a letter of request to the Public Utilities Director and the owner must make a written application to the City Council for permission to make such connections. The application must be accompanied with sealed plats of the property to be served.

The plans, maps, and other documents for water, sewer, and reuse lines will be reviewed by the Public Utilities Department for a recommendation on whether to approve or disapprove the application. The water and sewer extension recommendations will be sent to the City Council so a final decision concerning the connection may be made. All water, sewer, and reuse lines providing service to adjoining properties shall be properly dedicated to the City prior to the connection of the system and shall be built to City standards, where applicable. The utility lines dedicated to the City shall include main distribution lines, services from mains to meters, valves, hydrants, and other fixtures to form the system, but will not include service lines leading from the meter to the building connections.

If any easements or right-of-way contracts are needed for the extension of mains over privately-owned lands, the developer shall acquire these easements at no cost to the City. In this case, all easements shall have functional access to public right of way, be properly recorded, and the City of Raleigh Public Utilities Department Standard Procedure 602-4 shall be followed. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.

Once a utility system has been accepted, the City shall have complete control over the mains and connections for the purpose of making inspections and turning the water and/or reuse services on and off. The fees charged to the customers for the use of these lines shall be the same as those charged to other customers residing outside the City limits.

In times of emergency when the City needs the water to supply the needs of the citizens inside the corporate limits, the service to outside customers will be discontinued and ample notice of the cut-off will be provided to these users. The City cannot be held responsible to provide a certain water pressure and to furnish fire protection to those customers along these lines installed outside the corporate limits.

The following policy shall serve as minimum conditions under which the City shall eventually take responsibility for and accept private community utility lines into the public system:

1. City standards were used as the minimum design and construction standards for such a system.
2. The system is supplied by a central temporary source from wells, pumps, and tanks and/or a sewage disposal system.
3. The system owner shall provide for the water, sewer, and/or reuse systems in streets and easements to become part of the City's utility system without any cost to the City.
4. The value of the well, tank, pump and/or sewage disposal plant shall be retained by the system owner.
5. All lots connecting to the utility system shall bear their share of the acreage fee, which must be paid as a lump sum.

ACREAGE FEE REIMBURSEMENT

The developers may be reimbursed for major utility mains if certain conditions are met. The major mains are those water and sewer lines that are 12 inches and larger in diameter. The policy is to reimburse the developer for the cost differential between the major mains and a 6-inch water and 8-inch sewer, whether inside or outside the corporate limits, from the acreage fees collected from connecting properties within the service areas, subject to a 10-year limitation on the reimbursement. In order to qualify for the reimbursement, the developer must have properly prepared plans and profiles for the major mains. These plans will have to be approved by the City. After completion and acceptance of the projects, a reimbursement contract will be prepared and submitted to the City Council for approval and then executed by the City and developer.

The acreage fees collected within a designated service area shall be used to reimburse the contract holder for the major utility mains installed in that area. The reimbursement payments shall be made for a period of ten years after acceptance of the project and no longer. If more than one contract is outstanding for a service area, then the reimbursements will be made based on the order that the contracts

were signed. The details of this reimbursement are outlined in the City of Raleigh Public Utilities Department Standard Procedure 700-6 (see Section F).

JOINT VENTURE AGREEMENT

Joint venture agreements in accordance with this procedure are defined as private reimbursement contracts and are subject to City Council approval of the plans and/or subdivision, site plan, etc. Joint venture agreements are entered into to provide water and sewer service as part of the City's plan to serve an area in the extraterritorial jurisdiction or to eliminate a public health and/or environmental concern. At least 1,000 linear feet of utility service must be provided and an area of 100 acres must be served. The developer must agree to petition for annexation, must either assign part of the reimbursement cost to the City or pay the City directly for the easement acquisition, must convey positive economic benefits to the City, and the developer agrees to provide a financial security deposit for the full cost of the project. The design must be completed by the project developer within six months of the City agreeing to the project. Pump stations are not eligible for participation by the City, and projects that can be served by gravity sewer may not be served by a pump station.

After approval of the concept, the developer must have the engineering plans prepared for the extension(s) of utilities outside of the proposed project site and provide such funds to cover the cost of installation. The City handles this as a public assessment project and holds the necessary public hearings so that assessments can be levied against the property. The project will be scheduled for a public hearing and the hearing will be held. After the project is approved by the Council, the City will finalize the acquisition of any necessary easements, the cost of which will be paid by the developer. The project will be publicly bid and a contract awarded. Construction is administered by the City. As assessments or fees in lieu of assessments are received, the City will use these funds to repay the developer, but reimbursements cannot exceed the contract amount. In the case of acreage fee and private reimbursement contracts, the total reimbursements will not exceed the actual construction costs plus any accrued interest. All reimbursements are made yearly, and these payments are made in January of each year, following the acceptance of the utilities.

INFILL POLICY

It is the policy of the City of Raleigh Public Utilities Department (CORPUD) to achieve the replacement of vitrified clay sanitary sewer mains, galvanized water mains, and other deteriorated and/or undersized mains when "infill" development projects occur on or adjoining the property on which those mains are located.

The engineering plans review personnel in the CORPUD Administrative Office will identify instances in which this policy applies and determine the size and linear extent of the replacement needed. They will notify the engineer through normal plan review comment process. The plans will be re-submitted and permitted including the needed replacement.

The developer and/or engineer will obtain, through informal quotes or public bidding as appropriate from a North Carolina licensed utility contractor, a price for the replacement main work and will submit that price and the name of the utility contractor to the Public Utilities Director for approval prior to commencing work on the main replacement work. Upon approval of the project cost by the City, the contractor shall proceed with the main replacement work.

The main replacement work will be considered as part of the general project scope in terms of inspection, acceptance, etc. Upon final acceptance of the replacement work, as documented by City inspectors, CORPUD will reimburse the developer the cost of the replacement main, based upon initial cost submittal or the effective full diameter price for that size of main based upon current Acreage Fee reimbursement tables, whichever is **less**. In those cases in which the cutting and restoration of public streets, replacement of aerial mains, or other special work are required in order to accomplish the required main replacement, additional compensation or provisions will be established by the Public Utilities Director for that work. The developer is responsible for all of the costs other than the main replacement cost, which is reimbursed by the City.

USE OF THE SANITARY SEWER SYSTEM

The use of the sanitary sewer system in the City of Raleigh is fully described in Article C of the City Code. A brief summary of some of the terms that relate to the sewage treatment system are stated below.

Section 8-2013 of the City Code makes it unlawful to destroy or interfere in any way with any part of the City sewer system or to deposit any solid or liquid substances directly into any manhole. Also, it sets a limit on certain amounts of biological and toxic wastes that can be discharged into the sewage system. Failure to comply with either of these can result in a civil penalty of not more than \$25,000 per incident. These limits are necessary so that the biological treatment process can be maintained at acceptable levels. A procedure has been developed so that persons generating waste over the prescribed limits may pre-treat it, apply to the City for permission to regulate the rate of discharge so that it is at an acceptable level, or apply to the City for permission to discharge certain wastes, but to pay a surcharge equal to the extra treatment cost. These details can be found in Section 8-2114 of the City Code.

The City of Raleigh has an Industrial Pretreatment Program and discharges exceeding the defined waste limits are to submit an industrial pretreatment application, in addition to the surcharges. The application must be approved by the City prior to connection and discharge into the public sewer system.

The City policy is to utilize gravity flow sewers unless it has been determined to be economically infeasible or physically impossible by the City to provide sewer service without relying on pump stations. In situations where the City has offered a joint venture, a pump station may not be used. In situations where gravity sewer is not available and a pump station could be put in to just serve the property, the City may consider the installation of a privately owned and maintained pump station

and force main. See the Sewer Section of this book and Details S-35 through S-37.

The City Code in Section 8-2119 states: "All existing and proposed food preparation or serving facilities and vehicle maintenance facilities connected to the City of Raleigh sanitary sewer system must have a properly sized and maintained grease trap or interceptor installed at a location on their sewer service so as to prevent the discharge of oil and grease to the City of Raleigh sewer system." See Details S-40 and S-41. The facilities where grease traps or interceptors are located must have records on-site and available for staff review, indicating the history of their grease trap maintenance. Failure to comply with the requirements of this section of the Code, will result in the issuance of a Notice of Violation, Civil Penalty assessment, and, if necessary, temporary or permanent interruption of water, sewer, and/or reuse service from the City of Raleigh.

USE OF THE REUSE SYSTEM

The use of the reuse system in the City of Raleigh is fully described in Article E of the City Code. The City of Raleigh encourages the beneficial use of the State's water resources concurrent with the protection of public health and the environment. As such, the City encourages the use of reuse water for any approved purpose when economically and technically feasible. Utilization of reuse water for non-potable purposes alleviates demand on our limited potable water resources and helps protect the environment by reducing discharges to our rivers.

The City of Raleigh has developed a master plan for a reuse distribution system. Development projects may be required to install reuse distribution systems in accordance with the master plan. Please contact the Public Utilities Department to determine if reuse water is available to a development site.

Reuse water is not intended for direct human consumption. All North Carolina State requirements for reclaimed water must be met as specified by NC DENR. Public protection is ensured through State Laws (North Carolina Administrative Code Title 15A, Subchapter 2H, Section .0200), identification of reuse water through signage and the use of purple-colored piping and equipment, and continuous monitoring of water quality. All buffers and runoff requirements specified in Section 8-2206 of the City Code must be met for irrigation with reuse water.

OTHER POLICIES

SEWAGE BACKFLOW POLICY

Section 10-6084 of the Code deals with fixtures and drains subject to sewage backflow. This section requires that the all-plumbing traps shall be installed with an elevation at least one foot higher than the elevation of the top of the next manhole upstream from the property connection. If not, the property must have a backwater valve on the sewer service to protect against backflow and the property owner must sign a sewer release waiving the City's liability in case of a backflow.

This form will become a recorded document on the property. The liability release form can be obtained in the City Inspections Department.

FLOOD POLICY

In flood prone areas, the manholes must be watertight and vented to one foot above the 100-year flood elevation or must be built one foot above the anticipated 100-year flood elevation as determined by the U.S. Army Corps of Engineers. Pump stations must be constructed above the 100-year flood elevation as determined by the US Army Corps of Engineers.

MANHOLES IN STREETS

All manhole covers installed within streets, parking lots, and other paved areas shall have only one one-inch hole, which shall be off center and fitted with a rubber grommet, unless sealdown manholes are required. All covers must be domestically cast and so indicated by manufacturer name and "USA" in castings. Covers shall have "DANGER PERMIT REQUIRED – CONFINED SPACE DO NOT ENTER" cast onto the face as shown in details W-21 and S-25.

LOCATION OF UNDERGROUND UTILITIES

Before commencing any excavations in any highways, streets, public spaces, or in an easement, the State of North Carolina Underground Damage Prevention Act requires notification of each utility owner having underground utilities located in the proposed area to be excavated, either orally or in writing, not less than two nor more than ten working days prior to starting, of the intent to excavate. If planning on digging, excavating, demolishing, or moving the earth in any way that could damage underground utility facilities, call the North Carolina One-Call Center toll free number 48 hours before you plan work to begin. The toll free number is 1-800-632-4949.

SERVICE CONNECTIONS IN SEWER EASEMENTS

Sewer service connections in existing sewer main easements shall be installed only by licensed utility contractors or licensed plumbers and no service connections shall be made to trunk or interceptor sewers 15-inches in diameter and larger. Services on 15-inch and larger mains will require connection at an existing manhole or the installation of a manhole.

SEWER MAIN/EASEMENT RELOCATION POLICY

Encroachments in easements are discouraged. In cases where they are necessary and technically feasible in accordance with the City of Raleigh design standards, the Public Utilities Department shall consider requests for relocation of sewer mains and easements proposed as a remedial action to resolve conflicts such as encroachment of buildings, houses, and other such permanent structures. All easement relocations require City Council approval through sale of surplus property. The total cost of relocation of sewer mains and dedication of new

easements shall be at the expense of the property owner, including engineering cost, survey cost, recordation of maps, surplus property procedure, etc.

CONNECTION OF POOLS AND FOUNTAINS TO SANITARY SEWER

Swimming pools or ornamental fountains shall discharge to the stormwater system under the general permit issued by the Division of Water Quality. Where discharge to the storm sewer system is not possible and a swimming pool or ornamental fountain is connected to the sanitary sewer system for the purpose of draining or flushing the pool/fountain or backwashing the filters, the drainage system shall be equipped with a pump or flow restrictor so that the discharge rate to the sanitary sewer does not exceed 50 gallons per minute. The documentation of this flow rate must be provided to the Public Utilities Director.

CONSTRUCTION WATER/ FILLING OF SWIMMING POOLS/THEFT OF WATER

All water used from the City of Raleigh Public Utilities system must be metered except in the case of fire emergencies. Hydrant meters must be obtained from the Meters Division at (919) 250-2737. Water used from the City's water system without metering is a violation of the City Code and can result in the fine of a maximum of \$ 500.00/day plus water usage. Hydrant meters are issued as temporary water service and may be recalled at any time and for any reason by the Public Utilities Director. See the Water and Sewer Construction Standards included in this Handbook.

WATER BACKFLOW/CROSS CONNECTION

All existing and proposed water services, dedicated fire and irrigation lines, and private distribution systems must be provided with an approved backflow prevention assembly based on a "schedule of compliance" as determined by the Public Utilities Director. For projects having any combination of these lines, suitable approved devices must be provided to contain or "isolate" each level through containment. Questions concerning Raleigh's Backflow/Cross-Connection Prevention Program should be directed to the Public Utilities Cross Connection Coordinator at (919) 870-2897. A list of approved devices is provided in the Water section of this Handbook.

REUSE BACKFLOW/CROSS CONNECTION

The Public Utilities Director may require an approved backflow prevention assembly for any existing or proposed reuse services, dedicated irrigation lines, or private distribution systems. In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container. Questions concerning Raleigh's Backflow/Cross-Connection

Prevention Program should be directed to the Public Utilities Cross Connection Coordinator at (919) 870-2897. A list of approved devices is provided in the Water section of this Handbook.

WATER SYSTEM AND REUSE SYSTEM CONNECTIONS

In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container.

WELL POLICY FOR IRRIGATION SYSTEMS

The City Code indicates that wells for irrigation systems inside the City will require a permit from the City Inspections Division, along with a permit from the Wake County Health Department. There shall be no connection to the City's water system for a well installed for irrigation. Irrigation wells will not be permitted where reuse water is available. The procedure for applying for wells is established in the City of Raleigh Public Utilities Department Standard Procedure 607-4 (see Section F).

GROUNDWATER RECLAMATION WELLS

Groundwater reclamation wells are prohibited from discharging into the City sewer system.

DUAL UTILITY SERVICE POLICY FOR EXTRATERRITORIAL JURISDICTION AREA (TWO ACRE RULE)

Both water and sewer service connections must be provided for lots greater than two (2) acres existing as of April 17, 1984, in order to be eligible for one or the other of the utilities. In cases where both utilities are not available to a particular tract of land and the property owner wishes to connect to the one that is available, the property owner can prepay the appropriate assessment rate for the unavailable utility on an abutting footage basis and then be allowed to connect to the utility that is available. See Raleigh City Code Section 8-2063(B).

SCHEDULING REUSE SERVICES

The City will control and schedule the delivery of reuse water to residences and businesses based upon being able to maintain an acceptable working pressure and safeguarding public health. The City of Raleigh will provide a minimum pressure of 25 pounds per square inch (psi).

FORCE MAIN DISCHARGE POLICY

Force main discharges create the potential for introducing hydrogen sulfide gases into the existing sewer system. These gases, in turn, can cause rapid deterioration of unprotected concrete and metal sewer main materials. In order to prevent this rapid deterioration, it is required that manholes and sewer mains that receive any new force main discharge shall be upgraded by means of replacing the existing concrete, ductile iron, or cast iron main with PVC (if depths allow) or replacing the existing main with ceramic epoxy lined ductile iron or polyurea coated concrete pipe (see "sewer materials" section of these specifications). The extent of this main replacement will be no less than to the next manhole upstream and downstream from the manhole in which the new force main discharges into. In addition to main replacement, the manhole in which the force main discharges into shall be vented and be replaced with a polyurea coated manhole (see "sewer materials"). The developer is responsible for all of the costs associated with this upgrade.

EXISTING MATERIALS POLICY

Any existing water or sewer main materials (i.e. fire hydrants, valves, etc.) that are to be relocated or removed during a specific project shall not be reused in the City of Raleigh Public Utilities System.

IRRIGATION SYSTEM POLICY

All new permanent in-ground irrigation systems shall be individually metered. The irrigation service line can be directly tapped into the main or split off of the domestic service prior to the meter (see detail W-35). Either method of connection shall be performed by the City of Raleigh Public Utilities Department or a licensed utility contractor. All permanent in-ground irrigation systems shall also be equipped with an approved programmable controller for adjustment of irrigation frequency and intensity. A functional rainfall sensor shall also be installed on all permanent in ground irrigation systems and shall be set at 1/4". Rain sensor shall be installed per the manufacturer's recommendation in a location that will allow for proper operation and be at least 5' from a house or building. Specifications for controllers and rain sensors can be found in the "Water Materials" section of these specifications. Information on tap fees for either connection method can be obtained by calling the City of Raleigh Inspections Department at 890-3701.

WATER, SEWER, AND REUSE FEES

The City has several fees, which are related to its water, sewer, and reuse systems. These fees are normally adjusted at the beginning of each fiscal year, which begins on July 1. Please contact Public Utilities at (919) 857-4540 for the current fees. Please contact the City Inspections Department, Permit Division at (919) 890-3450 for a determination of the total amount due for a particular site. These fees will be defined and discussed below:

Acreage Fee - Acreage fees will be charged to all property owners inside or outside the City for connecting to the City's water and sewer systems. This fee will be collected at the time of building permit application for new construction or at the time of the connection for existing buildings in order to reimburse for major utility mains. The general exception for acreage fees is: for property owners who were tapped onto the system prior to June 1, 1959. This fee is based on the acreage of the site, except for residential, which is a fixed fee per unit permit.

Schools Policy – Section 8-2092(b) of the City Code indicates that public elementary schools will pay acreage fees based upon a maximum of four (4) acres, junior high schools will pay acreage fees based upon a maximum of seven (7) acres, and high schools will pay acreage fees based upon a maximum of ten (10) acres. A public or qualified nonpublic school may be exempt from water and sewer acreage fees when they have installed offsite public water and sewer extensions.

Recreational Facilities - Section 8-2092 (b) of the City Code indicates that parks and recreation facilities will pay their acreage fees based on a maximum of three (3) acres for each connection, for a maximum total of seven (7) acres, at the appropriate acreage fee rate for the facilities property zoning. Although not defined in the Code, facilities which are covered under the park and recreation acreage fee limit in this section include athletic fields (soccer, softball, etc.), golf courses (USGA regulation, par 3's, and driving ranges), and nature parks (City, State, etc.).

Assessment Fee The minimum size mains are six inch and eight inch for water and sewer mains, respectively. For corner and dual frontage lots, the property owner may receive a 150-foot exemption. When utility mains are installed inside the corporate limits by the City, the adjoining property owners are charged an assessment fee for the improvements. These fees are based on the cost of installing a six-inch water main and an eight-inch sewer main. This fee is a lien on the property and can be paid over a ten-year period at 6% interest. Each fiscal year these fees are revised to reflect changes in the cost of installation.

Fee in Lieu of Assessment – Properties outside the City are not assessable, so a charge called a "fee in lieu of assessment" will be made outside the corporate limits because the City cannot assess this property. The "fee in lieu of" is due at the time of connection onto the water and/or sewer system or at the time of annexation into the City.

Service Installation ("Tap") Fee - A fee is charged to cover the cost of installation by the City of water, sewer, and reuse service lines extending from the main to the edge of the right-of-way or private property. The City has set fees for $\frac{3}{4}$ inch through one-inch water services, four-inch sewer service, and $\frac{3}{4}$ inch through one-inch reuse service, or a service tap may be installed by a licensed utility contractor.

Meter Installation Fee - The Public Utilities Department installs all water and reuse meters connected to the Raleigh water system. Charges for such installation, based upon meter size, have been adopted and are periodically updated. A Not Ready Fee is charged when the City has attempted to initially install the water meter and determined that the water service stub was either not installed to the property or the water service stub was not installed in accordance with City standards.

Neuse River Nutrient Reduction Fee - This fee is assessed to cover the costs for reduction of nutrients discharged into the Neuse River, a schedule has been adopted and is updated annually. This fee is collected at the time of utility permit issuance. This fee applies to all new sewer taps and existing taps prior to September 1, 1998.

Sewer Permit Fees - The City issues sewer extension permits on behalf of the North Carolina Department of Environment and Natural Resources Water Quality Division. These fees are due at the time of submittal of engineering drawings. There is a permit application processing fee charged by the City.

Water Permit Fees - The City issues water extension permits on behalf of the Department of Environment and Health. These fees are due at the time of submittal of engineering drawings.

Reuse Permit Fees - The City issues reuse extension permits on behalf of the North Carolina Department of Environment and Natural Resources Water Quality Division. Where applicable, these fees are due at the time of submittal of engineering drawings. There is a permit application processing fee for reuse charged by the City if no other utilities are being submitted for review.

Outside Sewer Connection Fee - Property located outside of the City limits will pay a sewer connection fee of \$200 for each dwelling or unit which is tapped onto the City's wastewater system. The fee is collected at the same time as acreage fees, as discussed above. In cases where the petitioned annexation will be accepted, the City may waive this fee as determined by the Planning Department.

PERMITS

During the course of designing and prior to constructing a utility project, various permits from the City and State government must be secured. Below is a brief description of some of the major permits that may be required on these projects. The City of Raleigh permits will be discussed, followed by a brief discussion of the necessary State permits:

CITY OF RALEIGH PERMITS

Prior to the construction, but after appropriate City approval of the utility project, the following permits may be required. Fees may be required for these permits. The City Inspections Department Permit Office is located in the Raleigh Municipal Building at 222 West Hargett Street. The Permit Section of the City's Inspections Department can assist the engineer or contractor with the following items:

- a. Grading Permit - If the disturbed area is in excess of 12,000 square feet, the contractor or engineer must secure a Grading Permit. Plans showing the soil erosion control measures must be included in the project plans. Grading plans that require cut or fill that reduce the minimum cover or exceed the maximum cover must be submitted to the Public Utilities Department.
- b. Floodplain Permit - If any construction is taking place in a designated floodplain, a Floodplain Permit must be required. Manholes installed in a floodplain must be built one foot above the hundred-year flood elevation or be of a waterproof design.
- c. Stub Permit - A Stub Permit is required to connect to the City service main and requires an inspection of the service line running from the main to the property line or easement line.
- d. Utility Connection Permit - The Utility Connection Permit is the primary permit required to connect to the City water, sewer, and/or reuse system. This permit includes such things as the acreage fee on a parcel of land, any outstanding assessments on the property, a fee in lieu of assessments when appropriate, and will include the City installation fees if the services are going to be installed by City forces.
- e. Plumbing Permit – The Plumbing Permit includes the inspection fees for the on-site water, sewer, and reuse lines running from the building project back to the service stubs. This is required when a licensed plumber installs a service line and/or an irrigation RP is set.
- f. Plumbing Utility Permit – The plumbing utility permit includes the inspection fees for a utility contractor to run water and sewer services to within 5' of commercial buildings from the main.
- g. Right-of-Way Permits - The Right-of-Way Permits are required and must be approved before actually working in the right-of-way. The contractor must

secure a traffic authorization from the Department of Transportation (DOT) for work on major thoroughfares or on the streets with marked centerlines, before the Inspections Department will issue the right-of-way permit. The details of the special traffic authorization can be found in the DOT's Handbook on Construction Work Zone Signing.

- h. Street Cut Permit - A Street Cut Permit is required to cut the street for installation or excavation in the right-of-way.
- i. Irrigation Well Permit – A Well Permit is required from the Wake County Health Department as well as the City Inspections Department for an irrigation well inside the City limits.

BLASTING PERMIT

A Blasting Permit is required whenever blasting is taking place. It may be applied for in the Fire Marshal's office, (919) 831-6392.

WATER, WASTEWATER, AND REUSE SYSTEMS PERMITS

Prior to City design approval of a project the engineer or owner must secure a Wastewater Discharge Permit, a Water Supply System Permit, and/or a Reuse Supply System Permit for each project, if applicable.

Wastewater Discharge Permits

The Environmental Management Commission of the North Carolina Department of Environment and Natural Resources has delegated the City of Raleigh's Public Utilities Department the authority to issue wastewater discharge permits for projects within the City's jurisdiction.

Water Supply System Permits

The Public Water Supply Section, Division of Environmental Health, North Carolina Department of Environment and Natural Resources has delegated the City of Raleigh's Public Utilities Department the authority to issue water supply system permits for projects within the City's jurisdiction.

Reuse Supply System Permits

The City of Raleigh Public Utilities Department Standard Procedure 602-5 describes the application process for these permits (see Section F). The applications must be filled out and returned with the appropriate application filing fees to the Public Works Department.

A developer, engineer, or contractor shall not proceed with the main installation prior to the construction authorization by signatures on the plans. If a developer, engineer, or contractor does proceed, the City may require the work to be removed and reinstalled subsequent to issuance of the permit(s), and the

developer, engineer or contractor shall be fully liable for all costs and actions, including criminal prosecution by the State for proceeding with installation prior to issuance of the appropriate permit(s).

NEUSE RIVER RIPARIAN BUFFER RULE

It is the responsibility of the engineer/developer to verify whether a Neuse River Riparian Buffer certification is required. If required, it is the developers/engineers responsibility to obtain the necessary certification and see that any conditions are strictly adhered to.

WETLAND PERMIT

It is the responsibility of the developer/engineer to verify wetlands exist on a project. If wetlands are present it is the developer's/engineer's responsibility to obtain necessary permits from other agencies and see that any conditions are strictly adhered to.

NCDOT ENCROACHMENT PERMIT

If a project involves a State maintained road or highway, the engineer or contractor must submit the necessary highway encroachment forms to the North Carolina Division of Highways. The encroachment agreement must first be executed by the City of Raleigh through the Public Works Department. The engineer will pick-up executed forms from Public Works and then deliver them to NCDOT.

EASEMENT MAP REQUIREMENTS

The City of Raleigh is standardizing the format for plat information. The following items must be included:

- 1) Minimum scale established – 1 inch = 50 feet
- 2) Project title – consistent with council authorization
- 3) Vicinity map
- 4) Identify map number of total (example: map #9 of 14)
- 5) Street number on each parcel
- 6) Owner name on each parcel
- 7) Successive lot numbers on each parcel – beginning with Lot #1
- 8) Locate footprint of structure on parcel
- 9) Reference any recorded easements on each parcel
- 10) "Line" legend somewhere on map
- 11) Owner/parcel/take data table somewhere on map to include: Owner's name, street address, Wake county Tax ID # (7 digit #), Lot #, each take listed, Parcel Deed Book and page number
- 12) No easements labeled "utility"

STANDARD PROCEDURES

To ensure that the Public Utilities Department is providing the best level of service possible to the citizens, the Public Utilities Department has developed several standard procedures for operating and checking the various elements of the utility system. A partial listing of the major procedures applicable to this Handbook are described below. Efforts are made to maintain the standard procedures to reflect current and correct City policies. In any case of inconsistency between a standard procedure and this Handbook or the City Code, the Handbook and City Code supersede the standard procedure.

Standard Procedure 602-5 - Construction Approval for Water, Sewer, and Reuse Main Extensions. This procedure establishes the methodology for securing the appropriate state water, sewer, and reuse construction permits.

Standard Procedure 602-6 - Fee-In-Lieu-of-Water, Sewer, and Reuse Mains. The purpose of this procedure is for the tracking of "Fee-in-lieu-of assessment" for water, sewer, and reuse mains after they have been installed.

Standard Procedure 602-7 - Service Stub Connection Fees. The purpose of this procedure is to develop the steps for posting, dating, and collecting of fees for the water, sewer, and reuse service stubs installed either by City forces or by contract.

Standard Procedure 604-1 - Water and/or Sewer Service Renewal. This procedure establishes a policy for the renewal of water services other than copper and sewer services other than cast iron.

Standard Procedure 604-3 - Fire Hydrant Meters, Use and Installation. This procedure describes the uses of fire hydrant meters and establishes a procedure for installing such meters. These meters can be used by contractors for daily temporary water sources or can be used by residents to fill swimming pools.

Standard Procedure 604-4 - Design and Installation of Water Mains and Services. This procedure describes the guidelines for designing and installing water mains and services.

Standard Procedure 604-5 - Fire Service Line Installations. This procedure outlines the City policy for installing fire service lines in private property for the purpose of delivering water for fire protection and/or sprinkler systems.

Standard Procedure 604-7 - Water Valve and Fire Hydrant Operation. This establishes a formal procedure for the operation of fire hydrants and water valves within the City's water system. This procedure informs the Utility Department of any valves that are being closed so that such information may be relayed to the Fire Department so that they will know which lines are affected in times of an emergency.

Standard Procedure 607-3 - Bacterial Test of New Water and Reuse Main. This procedure establishes the steps for preparing, sampling, bacterial testing, reporting and releasing of new water and reuse mains for domestic use in the City

of Raleigh. This procedure also outlines the conditions for chlorination testing of all new lines.

Standard Procedure 607-4 - Wells. This procedure establishes the guidelines and enumerates the various requirements, laws, and ordinances pertaining to the use of water obtained from sources other than the City's water supply system.

Standard Procedure 700-3 - Inspection and Acceptance of Streets and Utilities. The purpose of this procedure is to provide for the acceptance of streets and utilities as built in conjunction with approved subdivisions.

Standard Procedure 700-6 - Reimbursement Contracts for Utilities and Streets. This outlines the steps for the application and administration of reimbursement contracts for utilities and streets.

Public

Water Distribution / Extension System

The City of Raleigh consents to the connection and extension of the City's public water system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Private

Water Distribution / Extension System

The City of Raleigh consents to the connection to its public water system and extension of the private water distribution system as shown on this plan. The material and constructions methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Public

Sewer Collection / Extension System

The City of Raleigh consents to the connection and extension of the City's public sewer system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Private

Sewer Collection / Extension System

The City of Raleigh consents to the connection to its public sewer system and extension of the private sewer collection system as shown on this plan. The material and constructions methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Public

Reuse Distribution / Extension System

The City of Raleigh consents to the connection and extension of the City's public reuse system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Private

Reuse Distribution / Extension System

The City of Raleigh consents to the connection to its public reuse system and extension of the private reuse distribution system as shown on this plan. The material and constructions methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

ATTENTION CONTRACTORS

The **Construction Contractor** responsible for the extension of water, sewer, and/or reuse, as approved in these plans, is responsible for contacting the **Public Works Department** at (919) 831-6810, and the **Public Utilities Department** at (919) 857-4540 at least twenty four hours prior to beginning any of their construction.

Failure to notify both **City Departments** in advance of beginning construction, will result in the issuance of **monetary fines**, and require reinstallation of any water or sewer facilities not inspected as a result of this notification failure.

Failure to call for **Inspection, Install a Downstream Plug**, have **Permitted Plans** on the **Jobsite**, or any other **Violation of City of Raleigh Standards** will result in a **Fine and Possible Exclusion** from future work in the **City of Raleigh**.

ATTENTION CONTRACTORS

The **Construction Contractor** responsible for sewer pump stations and force mains, as approved in these plans, is responsible for contacting the **Public Works Department** at (919) 831-6810, and the **Public Utilities Department** at (919) 857-4540 at least twenty four hours prior to beginning any of their construction.

Failure to notify both **City Departments** in advance of beginning **construction**, will result in the issuance of **monetary fines**, and require reinstallation of any water or sewer facilities not inspected as a result of this notification failure.

Failure to call for **Inspection, Install a Downstream Plug**, have **Permitted Plans** on the **Jobsite**, or any other **Violation of City of Raleigh Standards** will result in a **Fine and Possible Exclusion** from future work in the **City of Raleigh**.

Public Utilities Department

Private System Forms

Private Sewer Pump Station and Force Main Application

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone 919-516-2155 fax 919-516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27601 phone 919-847-4540 fax 919-857-4545

Fee \$300 Check made payable to: City of Raleigh		
Applicant Information		
Applicant		
Organization		
Mailing Address		
Phone		
Project Information		
Project Name		
Project Location		
Project Description		
Number of Units Served	Estimated Completion Date	
Wastewater Information		
Type of Wastewater	<input type="checkbox"/> Domestic <input type="checkbox"/> Industrial	Average Daily Flow (gallons)
Tributary to Wastewater Plant		<input type="checkbox"/> Neuse River
Engineering Firm Information		
Engineering Firm	Contact	
Mailing Address	Phone	
Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317		SEAL
Signature	Title	
Date		
Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary. Signature _____ Registration # _____		

Non-Discharge Application Form Attachment Pump Station and Force Main

1	Owner/Operator Name (as shown on application)					
2	Pump Station # _____ (Please submit a separate sheet for each pump station and a project location map showing this pump station and closest creek, river, lake, etc.)					
3	Number and size of pumps:				GPD	each
Maximum Capacity of Station				GPD		
4	Pump Station Requirements					
Generator				Area Light		
Wet Well Vented with Screen				110V Convenience Outlet at Control Panel		
Filletts in Wet Well				Flood/Buoyancy Protection		
Air Release Valve (number)				High Water Alarms		audible visual
Check and Gate Valves				SORPUD SCADA		
Security Fencing				Odor Control		
Lockable Wet Well Cover				All weather driveway with vehicle turnaround		
5	Pumping cycles					per hour
6	Ductile Iron Force Main					
	Length	Diameter	Minimum Cover	High Point	Low Point	Total Dynamic Head (design)
7	Is pump station subject to flooding?					Yes No
8	100 year-flood elevation					Feet MSL
<p>Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.</p> <p>Signature _____</p> <p>Registration # _____</p>				SEAL		
<p>Amended North Carolina Department of Natural Resources and Community Development Division of Environmental Management Non-discharge Application Form Attachment Pump Station and Force Main PA-2(7-1-8)</p>						

Private Gravity Sewer Application

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone (919)516-2155 fax (919)516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27602 phone (919)847-4540 fax (919)857-4545

Fee \$200 Check made payable to City of Raleigh

Applicant Information

Applicant

Organization

Mailing Address

Phone

Project Information

Project Name

Project Location

Project Description

Number of Units Served

Wastewater Information

Type of Wastewater ☐ Domestic ☐ Industrial

Average Daily Flow (gallons)

Tributary to Wastewater Plant

Contractor Information

Contractor Installing Sewer

Company Name

Contact Name

Company Address

Mailing Address

Phone

Estimated Completed Date

Engineering Firm Information

Engineering Firm

Contact

Mailing Address

Phone

Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317

SEAL

Signature

Title

Date

Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.

Signature _____ Registration # _____

Non-Discharge Application Form Attachment for Gravity Sewers

1	Owner/Project Name (as shown on application)						
2	Total length of sewer pipe (by diameter size)						
	Diameter (inches)	Length (linear feet)	Material	Minimum	Slope Maximum	Slope Minimum	
3	Maximum sewer reach length between manholes					Linear Feet	
Does owner/Operator have the ability to clean this?					Yes	No	
4	Sewer subject to traffic bearing loads?					Yes	No
5	Maximum Allowable infiltration/exfiltration test rate in GPM/in/mile					GPM/in/Mile	
6	Minimum separation distances as shown on the plans or addressed in the specifications.						
100 feet horizontal separation from wells or other water supplies					Yes	No	
12 inch vertical separation,					Yes	No	
or Ferrous pipe sanitary sewer specified					Yes	No	
10 feet horizontal separation from water mains,					Yes	No	
or 24 inch vertical separation,					Yes	No	
or Ferrous pipe sanitary sewer specified					Yes	No	
7	100 year-flood elevation						
Are manholes subject to flooding?					Yes	No	
If yes, are manhole rim elevations 2 feet above 100-year flood level					Yes	No	
<p>Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.</p> <p>Signature _____ Registration # _____</p>							
<p>Amended North Carolina Department of Natural Resources and Community Development Division of Environmental Management Non-discharge Application Form Attachment Gravity Sewers PA-1(7-1-87)</p>							

Private Water Application and Engineers Report

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone 919-516-2155 fax 919-516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27601 phone 919-847-4540 fax 919-857-4545

Fee \$200 Check made payable to: City of Raleigh

This application for a **Water Extension**
is being made under the approved **City of Raleigh Water System Management Plan and Engineers Report.**

Applicant Information

Applicant

Organization

Mailing Address

Phone

Project Information

Project Name

Project Location

Description

Number of Units Served

Information about pressure for extension

Estimated Completion Date

Engineering Firm Information

Engineering Firm

Contact

Mailing Address

Phone

Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317

SEAL

Signature

Title

Date

Engineer's Certification I _____, as a duly registered
Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications
attached hereto are constant with the above summary.

Signature _____ Registration # _____

Public Utilities Department

Public System Forms

Public Sewer Pump Station and Force Main Application

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone 919-516-2155 fax 919-516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27601 phone 919-847-4540 fax 919-857-4545

Fee \$300 Check made payable to: City of Raleigh

Applicant Information

Applicant

Organization

Mailing Address

Phone

Project Information

Project Name

Project Location

Project Description

Number of Units Served

Estimated Completion Date

Wastewater Information

Type of Wastewater ☐ Domestic ☐ Industrial

Average Daily Flow (gallons)

Tributary to Wastewater Plant

☐ Neuse River

Engineering Firm Information

Engineering Firm

Contact

Mailing Address

Phone

Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317

SEAL

Signature

Title

Date

Engineer's Certification I _____, as a duly registered **Professional Engineer** in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.

Signature _____ Registration # _____

Non-Discharge Application Form Attachment Pump Station and Force Main

1	Owner/Operator Name (as shown on application)					
2	Pump Station # _____ (Please submit a separate sheet for each pump station and a project location map showing this pump station and closest creek, river, lake, etc.)					
3	Number and size of pumps:				GPD	each
	Maximum Capacity of Station				GPD	
4	Pump Station Requirements					
	Generator			Area Light		
	Wet Well Vented with Screen			110V Convenience Outlet at Control Panel		
	Fillets in Wet Well			Flood/Buoyancy Protection		
	Air Release Valve (number)			High Water Alarms		audible visual
	Check and Gate Valves			SORPUD SCADA		
	Security Fencing			Odor Control		
	Lockable Wet Well Cover			All weather driveway with vehicle turnaround		
5	Pumping cycles					per hour
6	Ductile Iron Force Main					
	Length	Diameter	Minimum Cover	High Point	Low Point	Total Dynamic Head (design)
7	Is pump station subject to flooding?					Yes No
8	100 year-flood elevation					Feet MSL
Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary. Signature _____ Registration # _____					SEAL	
Amended North Carolina Department of Natural Resources and Community Development Division of Environmental Management Non-discharge Application Form Attachment Pump Station and Force Main PA-2(7-1-8)						

Public Gravity Sewer Application

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone 919-516-2155 fax 919-516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27601 phone 919-847-4540 fax 919-857-4545

Fee \$200 Check made payable to: City of Raleigh

Applicant Information

Applicant

Organization

Mailing Address

Phone

Project Information

Project Name

Project Location

Project Description

Number of Units Served

Wastewater Information

Type of Wastewater ☐ Domestic ☐ Industrial

Average Daily Flow (gallons)

Tributary to Wastewater Plant

☐ Neuse River

Contractor Information

Contractor Installing Sewer

Company Name

Contact

Company Address

Mailing Address

Phone

Estimated Completion Date

Engineering Firm Information

Engineering Firm

Contact

Mailing Address

Phone

Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317

SEAL

Signature

Title

Date

Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.

Signature _____ Registration # _____

Non-Discharge Application Form Attachment for Gravity Sewers

1	Owner/Project Name (as shown on application)						
2	Total length of sewer pipe (by diameter size)						
	Diameter (inches)	Length (linear feet)	Material	Minimum	Slope Maximum	Slope Minimum	
3	Maximum sewer reach length between manholes					Linear Feet	
Does Owner/Operator have the ability to clean this?					Yes	No	
4	Sewer subject to traffic bearing loads?					Yes	No
5	Maximum allowable infiltration/exfiltration test rate in GPM/in/mile					GPM/in/Mile	
6	Minimum separation distances as shown on the plans or addressed in the specifications						
100 feet horizontal separation from wells or other water supplies					Yes	No	
24" inch vertical separation,					Yes	No	
or Ferrous pipe sanitary sewer specified					Yes	No	
10 feet horizontal separation from water mains,					Yes	No	
or 24 inch vertical separation,					Yes	No	
or Ferrous pipe sanitary sewer specified					Yes	No	
7	100 year-flood elevation						
Are manholes subject to flooding?					Yes	No	
If yes, are manhole rim elevations 2 feet above 100-year flood level?					Yes	No	
<p>Engineer's Certification I _____, as a duly registered Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications attached hereto are constant with the above summary.</p> <p>Signature _____ Registration # _____</p>							
<p>Amended North Carolina Department of Natural Resources and Community Development Division of Environmental Management Non-discharge Application Form Attachment Gravity Sewers PA-1(7-1-87)</p>							

Public Water Application and Engineers Report

Public Utilities Department

For all development projects within Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 304, Raleigh, NC 27601 phone 919-516-2155 fax 919-516-2681

For all development projects outside of Raleigh's ETJ, please submit to:

One Exchange Plaza Suite 620, Raleigh, NC 27601 phone 919-847-4540 fax 919-857-4545

Fee \$200 Check made payable to: City of Raleigh

This application for a **Water Extension**
is being made under the approved **City of Raleigh Water System Management Plan and Engineers Report.**

Applicant Information

Applicant

Organization

Mailing Address

Phone

Project Information

Project Name

Project Location

Description

Number of Units Served

Information about pressure for extension

Estimated Completion Date

Engineering Firm Information

Engineering Firm

Contact

Mailing Address

Phone

Pursuant: City of Raleigh Code Ordinance Chapter 800 N.C. General Statutes Chapter 130 A-317

SEAL

Signature

Title

Date

Engineer's Certification I _____, as a duly registered
Professional Engineer in the State of North Carolina, hereby certify that the plans and specifications
attached hereto are constant with the above summary.

Signature _____ Registration # _____

WATER DESIGN STANDARDS

Unless otherwise indicated, all standards apply to both the public and private water systems. Described in this section are the general design standards, which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will continue to have quality water facilities along with an adequate fire protection system.

All engineering plans for public and private water systems must meet State and City minimum design standards as indicated in the most recent amended Rules Governing Public Water Supplies by the N.C. Department of Health and Human Services and/or the City of Raleigh Public Utilities Handbook, whichever is the more stringent. All projects must be certified by the engineer of record or the City Engineer. The engineer shall be responsible for determining the water pressure at the point of connection and adequacy for services at the highest point of the project. Water pressure zone information is available from the Public Utilities Administrative office.

Plan and profile drawings shall be prepared by a registered professional engineer signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. The design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. A separate landscaping plan must be submitted with the utility plan showing any proposed landscaping and all water and sewer utilities or easement. All adjacent tracts and topographic information must be shown on the landscaping plan. The water drawings and sewer drawings may be on the same sheets. Landscaping plans shall show all utility engineering drawings and shall be on paper 24 inches by 36 inches.

Once installed, certified surveyed “as built” plans shall be provided to the City showing the utilities. “As built” drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City.

1. WATER DESIGN – PUBLIC

a. Location Conditions for Design

- 1) All mains are to be within dedicated street rights-of-way except major transmission mains not affording direct service connection. Mains within the street right-of-way shall be a minimum of 5 feet from the outside of the pipe to the edge of the right-of-way. Greater separation may be required for greater depth. Water mains as specified by the City of Raleigh will be marked as indicated on Detail W-13.
- 2) Water mains shall be located either in the north or east side of the street pavement.

- 3) No permanent structures or impoundments shall be constructed on water mains, water transmission mains or within water easements.

b. Size

- 1) Major mains are to be sized according to the City of Raleigh Public Utilities Department.
- 2) In all residential districts, mains shall be six inch and eight inch, six inch to be used only where it completes a good gridiron, but in no case in blocks of more than 600 feet in length. Maximum length of six-inch and eight -inch lines, without connection to a larger main are 1200 feet and 2000 feet, respectively. The maximum length of dead end six-inch and eight–inch lines are 600 feet and 1200 feet, respectively, except as provided for cul-de-sacs in #4 below.
- 3) In all other zoning classifications, mains shall be 8-inch and 12-inch, 8-inch used only where it completes a good gridiron. The maximum length of 8-inch lines without connection to a larger main is 1200 feet.
- 4) Within residential cul-de-sacs, 800 feet and less (measured along the cul-de-sac centerline from the street centerline to the cul-de-sac radius point) in length serving densities of R-1 or R-4 a 6-inch water main is permissible and must end with a fire hydrant. If the cul-de-sac is serving a R-6 or greater density development, then a minimum of 8-inch main is required. Water main sizes shall not be reduced except at street intersections or at fire hydrant locations on cul-de-sacs.
- 5) When the proposed project or subdivisions is confined by natural topographic features or existing developments, and it is determined that the streets will not be extended to serve adjacent properties, then the mains shall be sized to provide adequate domestic and fire flows. In this case, the minimum main size for single-family residential zoning districts shall be 6 inch and for all other zoning districts shall be 8-inch.
- 6) The City of Raleigh is required to provide a minimum pressure of 20 pounds per square inch (psi). If an individual needs greater pressure, then it is his/her responsibility to incorporate the necessary booster pumping facilities.
- 7) Private fire lines for all land uses shall be a minimum of six (6) inches in diameter and shall be provided with either a double detector check valve or a reduced pressure detector valve, whichever is applicable and built to City standards.

c. Fire Hydrants

- 1) All fire hydrants shall be installed on a 6-inch branch with a hydrant branch valves on each branch. All hydrants are to be located at the right-of-way or in a two-foot easement adjacent to the right-of-way and installed as per Detail W-4. Fire hydrants on private property greater than 10 feet from the public right of way shall be private with the appropriate backflow devices. Fire hydrants on private property less than 10 feet from the public right of way shall be installed in recorded City of Raleigh water easements. The branch valve shall be no greater than one foot from the main and inside the pavement when possible. The valve shall be mechanically restrained to the main.
- 2) There shall be a fire hydrant located at each street intersection. All parts of all buildings or any structure shall be within 300 feet of a fire hydrant.
- 3) In all residential districts, the maximum distance between fire hydrants, measuring along public street centerlines and/or other private travel ways, shall be 500 feet.
- 4) Fire hydrants shall be spaced 300 feet measuring along public street centerlines, and/or other private travel ways if any non-single family residential uses exist on either side of a public street. There shall be a fire hydrant located within 150 feet of all supply connections for stand pipe and sprinkled buildings. Fire trucks must be able to get within 40' of the FDC connection.
- 5) On divided roads, fire hydrants shall be spaced 300 feet measuring along public street centerlines on alternating sides of the roadway.
- 6) When the relocation of an existing fire hydrant is approved by the Public Utilities Department, the existing hydrant branch will be plugged at the tee or tapping valve with a mechanical plug with no bends. If the existing main/tee is lead joint, the tap or tee will need to be cut out and a new section of pipe (nipple) installed with a ductile iron repair joint.
- 7) When hydrant extensions are used, they must be manufactured by the same manufacturer as the hydrant on which they are being used and installed in accordance with the manufacturer's instructions.
- 8) City of Raleigh public fire hydrants shall be painted red with high reflective silver caps, bonnets, and operating nut. Operating nuts on private fire hydrants shall be painted red. Hydrants connected to public mains 12-inch and larger the operating nut shall be painted black.

Town of Garner public fire hydrants shall be painted safety yellow with high reflective aluminum sheen caps, bonnets, and operating nuts. Operating nuts on private fire hydrants shall be painted safety yellow. Hydrants connected to public mains 12-inch and larger the operating nut shall be painted black.

- 9) No services are permitted on any fire hydrant branch.
- 10) Additional fire hydrants may be required by the Fire Department.
- 11) There shall be a 3' minimum clear distance around all fire hydrants. This means that nothing shall be within a 3' radius of all hydrants including but not limited to: trees, shrubs, fencing, guardrail, signs, light and utility poles, etc.

d. Valves

- 1) Each proposed new intersection shall have a main line valve for every leg i.e., a four-way intersection shall have four main line valves, a TEE intersection shall have three main line valves. All valves shall be rodde to a tee or cross in accordance with detail W-15.
- 2) Each fire hydrant shall have a hydrant branch valve, and installed as per Detail W-4.
- 3) Main line valves on straight runs between street intersections shall be spaced no greater than the distances given below and shall be located within fifty (50) feet of the nearest hydrant to their location.

<u>Main Size</u>	<u>Maximum Spacing</u>
6"	600'
8"	900'
12"	1000'
16"	1000'
24"	1500'

- 4) The high and low-pressure water distribution systems may be connected with specific approval of the Public Utilities Director. Such connections shall be made with approved check valves positioned with direction of flow from low to high pressure, and a fire hydrant shall be installed on the high-pressure side of the check valve. The check valve shall be installed in a standard manhole. A four foot manhole shall be used for six and eight-inch valves and a five foot manhole for twelve-inch valves. Larger size check valves shall be housed in a vault, and the size of the vault shall be approved by the Public Utilities Director.

- 5) Mains twelve inches and larger in diameter which have a change in elevation of fifteen feet or greater shall have an air release valve installed at the highest elevation of such change, as per Detail W-18. Additional air release valves may be required by the Public Utilities Director on mains less than 12-inches based on elevation changes of 15 feet or greater.
- 6) Any water service customer which has a water static pressure greater than eighty (80) psi is required by North Carolina State Building Code to install and maintain a pressure reducing valve. The pressure reducing valve will be installed on the building service line after the meter. Such a device must be installed before the City will allow the actual water connection. This installation is covered by the Plumbing Code and is not maintained by the Public Utilities Department.
- 7) Pressure reducing and/or sustaining stations shall be installed when directed by the Public Utilities Director to connect high and low pressure systems. The pressure reducing valve shall allow enough flow from the high side to maintain a specified pressure on the low side and will not reduce the high side below a certain amount. This type valve will be a pressure sustaining/ pressure reducing valve.
- 8) Valves over 10' in depth must have a valve stem extension to bring operating nut to a depth of no more than 5'.
- 9) Insert valves are only to be installed on a case by case basis as approved by the Public Utilities Director.

e. Meters

All water services will be metered, and the meter will be located in the rights-of-way or in a 2 foot easement adjacent to the rights-of-way.

Meters sizes shall be 5/8", 3/4", 1", 1 1/2", 2", 4", 6", 8", or 10" with no exceptions.

Any single water service that is to be used for domestic and fire service usage will have a minimum pipe size of 6-inch in diameter, pressure class 350 ductile iron pipe.

All single water services that are used for domestic and fire service usage will be required to have a Fire Service Meter with a by-pass meter.

Meters will be the same size in diameter as the service. The only exceptions are a 10-inch Fire Service Meter with a by-pass on a 12-inch water service line and a 5/8" residential meter on a 3/4" water service line.

All meters will be furnished and set by the Meters Division once all fees are paid and accounts have been set up. Meter installation and spacing shall be in accordance with details W-23 thru W-35

Additional connections and meters are allowed along with common master meters and services for the following categories (as defined in Section 10-2002 of the City Code) See Details W-23 thru W-35.

- 1) Group housing developments;
- 2) Townhouse developments;
- 3) Unit ownership (condominium developments);
1/31/2002
- 4) Planned unit developments;
- 5) Hotels, motels;
- 6) Hospitals;
- 7) Warehouses, industrial building (under one ownership and engaged in one business only);
- 8) Schools;
- 9) Mobile home parks;
- 10) Shopping areas;
- 11) Churches;
- 12) Rest homes.

If common (master) meters and services are used for the above categories, they must meet the following minimum requirements:

- 1) That the building(s) must comply with the City Zoning and Subdivision Ordinances.
- 2) That the building permit and plat show single ownership and a single lot.
- 3) That if one common meter is used, it should be located in the right-of-way. However, when a sidewalk is existing, the meter may be located in a 2-foot easement adjacent to the right-of-way. In no case shall meters be located inside of buildings.
- 4) That if more than one meter is installed, location on private property is permissible, provided that the site plans, prepared by a registered professional engineer, for the water construction are approved by the Public Utilities Department. All materials used between the main and meter shall conform to the City standards and specifications. The connections from the meter and water lateral to the individual buildings shall be in accordance with the North Carolina State Plumbing Code for the City.
- 5) That if a building is sold from the complex, then it will require a separate water service, with an individual meter with those services originating from a City maintained water main.

- 6) That a fire protection plan in triplicate be drawn up and approved by the Public Utilities Department and the Fire Protection Inspector. All water mains, valves and fire hydrants shall conform to the City's standards and specifications.
 - 7) The City will maintain all water connections within the street right-of-way at no charge to the property owner. Repairs on private property shall be the responsibility of the property owner or customer.
- f. Water Backflow/Cross Connection
- 1) All existing and proposed water services, dedicated fire and irrigation lines and private distribution systems must be provided with an approved backflow prevention assembly based on a "schedule of compliance" as determined by the Public Utilities Director and in accordance with City of Raleigh Code Part 8 Article D. For projects having any combination of these lines, suitable approved assemblies must be provided for containment of each level. Questions concerning Raleigh's Backflow/Cross-Connection Prevention Program should be directed to the Public Utilities Cross Connection Coordinator at 870-2897.
 - 2) On service lines serving a facility that is in operation continuously, the lines must have parallel backflow prevention assemblies on a single service line or adequate protection on each supply line to that facility. On parallel installations each assembly must be the same type (two double check valve assemblies, two double detector check valve assemblies, two reduced pressure zone device assemblies, or two reduced pressure zone detector check assemblies). In some cases, these assemblies must be the same size as the service line. The rule to normally use in this situation is that the assembly must have the square of the diameters equal to the square of the supply service "tap". For example, an 8-in service line would need at a minimum two 6-in devices in parallel.
 - 3) The Public Utilities Department approved backflow prevention assemblies shall be installed above ground. Assemblies may be installed inside of buildings as long as there are no unprotected taps between the main and the building. The minimum drain size in an above ground vault for double check assemblies and double detector check valves is 4 inches. An approved dual check valve must be installed at the meter service on single family residential service lines. OS&Y shut-off valves shall be used on all fire line backflow prevention assemblies (2 ½" or larger). All testable backflow prevention assemblies shall have approved test cock (as listed in section III.1.F.10). Approved installations are shown on Details W-34 thru W-39.

- 4) If the fire lines, private distribution systems or domestic service lines are connected to any "processed water" sources, or booster pump system, backflow protection shall be provided by using the USC approved Reduced Pressure principle zone assembly (RP) type assembly (fire lines require a reduced pressure detector assembly). "Processed water" is water where extra chemicals are added by the user on site to reduce freezing, pipe corrosion, etc. This RP assembly shall include the resilient wedge valves and test cocks, and the RP unit shall meet the requirements of AWWA standard C-506-78. If the RP assembly is 2½" or larger, then it must be supplied with OS&Y shut-off valves. The unit shall be housed in an above ground vault, insulated above ground enclosure, or inside of a building. RP's are required on all mall service connections due to change of use. No RP's may be installed below ground
- 5) If the backflow preventer is located on site for fire lines, then it shall be located outside the structure, which it is serving unless otherwise approved by the Public Utilities Department. **If there are no unprotected taps between the street and building it can be located in the building.** All internal or confinement assemblies (isolation assemblies) will have strainers upstream of the device with the exception of devices on firelines.
- 6) No person shall fill special use tanks or tankers containing pesticides, fertilizers, or other toxic chemicals or their residues from a public water system except at a location equipped with an approved air gap (2 X diameter of supply pipe with a minimum gap of 1") or an approved reduced pressure backflow preventer properly installed on the public water supply. No supplier of water shall permit the filling of such special use containers except at locations so equipped.
- 7) Backflow prevention assemblies shall be installed at a minimum height of 12 inches and a maximum height of 60 inches above the floor or ground. Assemblies shall also have a clear horizontal distance of 18 inches around the entire diameter of the device.
- 8) The backflow prevention assembly(s) must be readily accessible at all times. Readily accessible means that only a one piece cover must be removed for an outside installation to test or perform maintenance on the assembly.
- 9) Defacing a backflow prevention assembly will not be allowed. Defacing would include anything that might obscure pertinent information on that assembly (i.e.) nameplate, serial number, etc. Any assembly that is missing a nametag or information stamped in the body will not be considered to be an acceptable assembly installation and must be replaced upon notification by the City (This applies to new assemblies only).

- 10) Backflow prevention assemblies must be installed, tested and maintained by persons that have completed the City of Raleigh Cross Connection School or other approved Cross Connection School. It is also required that all assemblies be tested at the time of installation and annually thereafter. All assemblies must also have the rubber parts changed every five years.

The list of approved test equipment follows:

Mid-West Model	830, 844, & 845
Watts	TK-DP, All assemblies
Watts	TK-99D
Pro-Master	RP Test kit

* Test equipment shall be calibrated yearly.

All assemblies ¾-inch – 2-inch must have a ball valve that is full port, have a blow-out proof stem, have resilient seats and a 400 psi WOG rating (water, oil or gas). All assemblies 2 ½-inch–10-inch must have fusion bonded, epoxy coated resilient wedge valve. All test cocks must be approved ball valves of the appropriate size.

- 11) All backflow prevention assemblies installed outside of buildings must be installed in an approved enclosure with the exception of residential lawn irrigation backflow prevention assemblies. All enclosures shall be insulated and shall meet the requirements of ASSE standard 1060.
- 12) Double check valves and double detector check valves may be installed horizontally or vertically (see approved list). Reduced pressure backflow prevention assemblies shall be installed only horizontally.
- 13) All fire sprinkler system backflow prevention assembly enclosures shall be equipped with a heater that is recommended by the enclosure manufacturer.

g. Installation Restrictions for Design

- 1) All water mains, of proper size as determined by the Public Utilities Department, shall be installed complete, along all boundaries abutting existing public roadways, from property line to property line regardless of the land use, proposed lot arrangement of the subdivided property or the availability of connection to a main in service. Within all dead-end streets that may be extended, the water main must extend to the property line of the subdivision.

- 2) All water mains shall be installed with a minimum cover of 3 feet from the top of finished ground to pipe crown and shall be in accordance with all applicable City Standards.
- 3) When mains are to be installed to a dead end or mains are stubbed for future extension, at least one 18-foot joint of pipe, or more when required, shall be designed with a welded thrust collar and blow-off in accordance with Details W-7 thru W-12, of these specifications. All mains up to 12-inches in size shall be designed with a blow-off assembly the same size as the diameter of the pipe. The blow-off for 16-inch mains shall be 12-inch. The blow-off for 24-inch and larger mains shall require approval by the Public Utilities Director. Blow-off assemblies shall be in accordance with Details W-21&22 of these specifications. Mains which are determined to be extended in the future must also terminate with a full size main line gate valve prior to the last joint of pipe. Hydrants can be used as blow-offs on 6-inch mains, but must be rodged back to welded thrust collars as shown in Details W-7 & W-8.
- 3) Direct service connections shall be allowed on mains 16-inch and smaller installed in dedicated street rights-of-way. All service connections will be made perpendicular to the main. When two mains are existing in the street right-of-way, the main which provides the best flow and pressure for that parcel shall be tapped. This determination shall be made by the Public Utilities Department. No service connections are to be made off of fire hydrant branches or on fire lines except approved split services in accordance with Detail W-34.
- 4) Two (2) 45° bends shall be utilized for 90° turns of the water mains or branches. 90° bends are not allowed in the water distribution system.
- 5) Meter installations shall be in accordance with the applicable Details W-23 thru W-35. Only multiple meter installations may be located on private property. All other meters must be installed in the right-of-way or in approved easements adjoining the right-of-way. Meters must be installed adjoining the property they are serving and located on the same street as property address. All meters will be installed by the Public Utilities Department. Fees for such installation are adopted periodically by the City Council.

In non-residential water distribution systems, water meters may be located in the rear of the building with prior approval by the Public Utilities Department. The meters will be installed such that the meter locations conform to the units in the building as viewed from the rear of the building. The meters must be installed in an elevated area behind permanent curb and gutter or protected by bollards so that vehicles cannot be located over the meters. Each individual meter

must be labeled on the exterior with the address on a painted sign or painted on the pavement at the meter. Each meter setter must also have a permanent weatherproof tag wired on the angle valve by the plumber.

The following is a chart with the recommended residential water service sizes:

Full # Bathrooms	Static water pressure	Recommended service sizes
1	any	3/4"
2-3	≥ 60 p.s.i.	3/4"
2-3	< 60 p.s.i.	1"
≥ 4	any	1"

- 6) When multi-family developments and non-residential land uses are using gang meter installation, then the construction plans shall show the unit and meter numbering sequence for each building. Gang meter assemblies shall be located in front of the building. If the building number is odd, then the unit and meter letter sequence shall be read from left to right when facing the building. If the building number is even, then the unit and meter letter shall read from right to left when facing the building. See Details W-27 & W-28.

All service lines shall be connected to the correct meter based on sequential number or letter assignment. The unit and meter letter identification must be shown on the construction plans for installation approval. The correction of errors in the proper meter/unit pairing, detected later, will be the responsibility of the original installer or subsequent owners. The gang meter installation shall be in accordance with Detail W-26. Upon completion of the installation, tests will be conducted to prove order of connections is correct.

In the case of installation of a gang meter assembly the irrigation meter shall be the last meter in the sequence.

Gang meter assemblies shall be centered on the service line coming from the main as shown in Detail W-26.

2. WATER DESIGN - PRIVATE

Private water distribution systems located within the Raleigh Utility Service Area and proposed for connection to the City's public system now or in the future shall conform to all the public system standards listed within this document with the following conditions:

- a. Private water distribution lines shall not be required to be located within public right-of-way or publicly dedicated easements.
- b. 4-inch water mains may be installed in private water distribution systems, provided that, where the requirement that all parts of all buildings must be within 300 feet of a fire hydrant must be met.
- c. Private distribution systems located behind a master water meter will be built to the applicable State Plumbing Code and the Department of Human Services regulations.
- d. Private water systems, which are served by a temporary well as approved through an agreement between the City and the developer/owner and have dedicated streets and individual lots, shall be built to City standards. The only change is in the installation of the fire hydrant. The fire hydrant shall be painted yellow, meaning out of service, and the branch valve will be closed shut with the operating nut removed. The engineer shall note this on the construction plans prior to approval.
- e. Private distribution systems shall be looped to the public distribution system or have an approved backflow prevention assembly on dead end lines.

SEWER DESIGN STANDARDS

Unless otherwise indicated, all standards apply to both the public and private sewer systems. Described in this section are the general design standards which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will continue to have a quality sewer collection system.

All engineering plans for public and private sewer systems must meet State and City minimum design standards as indicated in the most recent amended Rules Governing Public Water Supplies by the N.C. Department of Environment, and Natural Resources and/or the City of Raleigh Public Utilities Handbook, whichever, is the more stringent. All projects must be certified by the engineer of record or the City Engineer.

Plan and profile drawings shall be prepared by a registered professional engineer signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. Design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. The water and sewer drawings may be on the same sheets. A separate landscaping plan must also be submitted with the utility showing any proposed landscaping and all water or sewer utilities or easement. All adjacent tracts and topographic information must be shown on the landscaping plan. Landscaping plans shall show all utilities and engineering drawings and shall be on paper 24 inches by 36 inches.

Once installed, certified surveyed "as built" plans shall be provided to the City showing the utilities. "As built" drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City.

1. SEWER DESIGN - PUBLIC

a. Location Conditions for Design

- 1) All public sanitary sewer mains shall be installed within dedicated street rights-of-way or City of Raleigh dedicated sanitary sewer easements. When sanitary sewer mains are installed in street rights-of-way, they shall be located in the center of the pavement or right-of-way where practical or in the south or west side of the pavement.
- 2) Minimum widths of permanent and construction sanitary sewer easements, for public sewer mains, are:

	<u>Permanent / Construction</u>
8" & 10" main	- 20/40* feet wide / 20 feet wide
12" & 15" main	- 30 feet wide / 20 feet wide

18" & 24" main - 40 feet wide / 20 feet wide

* 8" & 10" mains shall have a 20' radius easement from the center of all manholes (See detail S-43).

Larger size easements may be required based upon the depth of installation or other consideration as determined by the Public Utilities Department and Engineering Department. Sewer mains shall be centered in the easement. Under special conditions, temporary construction easements may be required upon approval of the Public Utilities Department. All sewer easement boundaries must be field staked and flagged by the developer's surveyor and at the developer's expense.

- 3) The minimum easement width for sanitary sewer is 20 feet and may not include any other utility. Such easements are to be recorded as "City of Raleigh Sanitary Sewer Easement".
- 4) All off-site easements shall be acquired by the developer. These off-site easements shall have functional access to public right of way and be recorded by map and by deed of easement prior to construction approval. The easements shall be dedicated to the City of Raleigh and entitled "City of Raleigh Sanitary Sewer Easement". Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.
- 5) No person shall place any part of a structure, any permanent equipment, or impoundment on sanitary sewer easements or mains. Prohibited structures include buildings, houses, air conditioning units /heat pumps, decks, garages, tool or storage sheds, swimming pools, walls, and fences. Fences may be allowed across easements as long as there is an access gate the full width of the easement. No fences may be installed longitudinally (lengthwise) within easements.
- 6) No person shall plant trees, shrubs, or other plants within a sewer easement without prior written approval from the Director of the Public Utilities Department. Any such plantings approved by the Director shall be done so at the risk of the property owner having to replace the plantings due to removal by the City during maintenance activities.
- 7) When preparing the plans for sewer mains, deflection angles for all horizontal turns shall be shown on the drawings. All elevations shall be tied to mean sea datum and the benchmark shall be shown or described on the plans. Spot elevations on 100 foot stations, 75 feet from the centerline on both sides, shall be shown on the plan, or cross-sections supplied to ensure that the sewer can adequately serve the property. The plans shall show the manhole number (MH

#1 etc.), top elevation, station, depth along with invert elevations, length of sewer reach, and slope (in percent). Established creek centerlines and inverts will be plotted on the sewer plan and profile sheets, adjacent to proposed sewer alignment, within 75 feet.

- 8) Proposed sewers paralleling a creek shall be designed to a proper depth to allow lateral connections, such that all creek crossings will be below the stream bottom elevation. When it can be demonstrated by the engineer that such sewer main would need to be at a depth greater than 16 feet to serve the opposite side of the creek, the Public Utilities Department may make an exception to this provision in the plan approval stage. The top of the sewer pipe should be at least 1 foot below the stream bed elevation and be of ductile iron pipe. All aerial stream crossings will be steel from manhole to manhole. The center line of a main paralleling a creek shall be a minimum of 40 or more feet as required by the Neuse Riparian Buffer from the top of the closest creek bank. Manholes along these sewers must be protected against the 100-year flood by raising top elevation one foot above or by providing sealed manholes (see S-24). All sealed manholes must be vented every 1,000 feet along the sewer line as per details S-24 thru S-27.
- 9) Aerial sanitary sewer crossings will be permitted only if they follow the Details S-10 thru S-19. The bottom of the aerial creek crossing pipe must be at least one foot above the 25 year flood elevation at the location.
- 10) Standard manhole tie-ins, and "tee" manholes, such as the Neuse River Interceptor manholes and tie-ins must follow the Detail S-33. Connection to "tee" manholes on the Neuse River Wastewater Plant Interceptor, Neuse River Interceptor, and Upper River Neuse Interceptor may be performed only by City forces or a contractor working for the City with the cost borne by the person extending the sewer mains from that point.
- 11) Sewer clean-outs are prohibited in driveways and parking lots and may only be approved upon special request to the Public Utilities Director. When necessary and so approved they must be installed with a standard water-tight clean-out plug within the cast iron valve box with a cast iron lid indicating "Sewer".
- 12) "Doghouse" manholes are allowed only on DIP and PVC sewer mains. "Doghouse" manholes on VCP are prohibited.
- 13) A dedicated and recorded driveway access easement shall be provided to all sanitary sewer siphons. Sanitary sewer siphons are only allowed in special circumstances and require approval of the Public Utilities Director. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.

- 13) A distance of 100 feet shall be maintained between any private or public water supply source, including any WS-I waters or Class I or Class II impounded reservoirs used as a source of drinking water. If this minimum separation can not be maintained, ductile iron sewer pipe with joints equivalent to public water supply design standards and pressure tested to 150 psi to assure watertightness, shall be used. The minimum separation shall however not be less than 25 feet from a private well or 50 feet from a public water supply well.
- 14) All existing waterworks units, such as basins, wells, or other treatment units, within 200 feet of the proposed sanitary sewer main shall be shown on the engineering plans.
- 15) Sanitary Sewer Services are not allowed in private easements.

b. Size

- 1) All gravity sewer mains shall be designed and sized to serve the total natural drainage basin. The total off-site drainage area in acres must be shown on the plans and calculations should be submitted to the Public Utilities Department upon request to justify pipe sizing. An 8-inch main shall be the minimum size permitted.
- 2) Sewer size design shall be based on an average daily flow of 100 gpcd and a peak/average ratio of 2.5. This ratio includes an allowance for infiltration. The following table should be used as a guide for determining the Equivalent Persons/Acre and the peak flow for various zoning classifications:

<u>Zoning</u>	<u>Equivalent Persons/Acre</u>	<u>Average Flow (gpcpd)</u>	<u>Peak Flow (gpcpd)</u>
R-2	5	500	1250
R-4	8	800	2000
R-6	14	1400	3500
R-10	21	2100	5250
Shop. Center	18	1800	4500
Bus./Comm.	25	2500	6250
O&I-1	13	1300	3250
O&I-2	30	3000	7500
Industrial	50	5000	12500

Sewer size design shall be to half full or 50% capacity for the maximum depth of flow for all grades.

- 3) Grades for sanitary sewers must be such that a minimum flow velocity of 2 feet per second is maintained. The minimum grade for an 8-inch sewer line is 0.50%.

- 4) Any grades which exceed the maximum of 10% must be approved by the Public Utilities Director and must be accompanied with details of a high velocity manhole as shown in Detail S-23. Any time the grade is greater than 15%, ductile iron pipe shall be used with high velocity blocking (anchoring) provided as per Details S-6 & S-7.
- 5) Pipe diameter changes shall occur in a manhole with the pipe crowns matched provided a minimum drop of approximately 0.20 feet is maintained between inverts.
- 6) Pipe material changes shall only occur in a manhole (i.e. DIP to PVC).

c. Manholes

- 1) Manholes shall be spaced a maximum distance of 400 feet apart for 8-inch through 21-inch diameter pipes, 450 feet apart for 24-inch and 30-inch diameter pipes, 500 feet apart for 36-inch diameter pipes and shall be installed at each deflection of line and/or grade.
- 2) The maximum "free" vertical drop for a gravity main into a manhole shall be 30 inches. Inside and outside drop manholes are not permitted. The maximum "free" vertical drop for a force main discharge into a manhole shall be 12 inches above the crown of the main.
- 3) Manholes will be supplied with a rubber boot sleeve that meets or exceeds ASTM C923 with stainless steel expansion bands and pipe clamps that meets ASTM C923 and A167 for connecting the sewer pipes with the barrel section. See Details S-20 thru S-29 for manhole standards. All traffic bearing castings must be Class 35 or greater. All exterior joints shall be wrapped with a butyl resin sealant of 8" width.
- 4) Eccentric or concentric cones may be used on 8-inch through 12-inch mains. On 15-inch and larger mains, concentric cones must be used.
- 5) The following minimum diameter manholes shall be used dependent upon the size mains and depth of installation. The larger manhole sizes will be required if either the main size or the depth warrants as follows:

Diameter Manhole	Main Size	or	Depth of Installation
4' - 0"	8" to 12"		0' to 12'
5' - 0"	15" to 30"		12' to 20'
6' - 0"	36" to 54"		20' and greater

Extended manhole bases may be used to minimize manhole diameter when a larger manhole is required because of the depth, in which case main size will dictate manhole diameter. Manhole sizes must be clearly identified on the construction plans. Each manhole must be of consistent diameter throughout its height.

- 6) The maximum flow deflection angle in manholes for sewer of 24 inch and greater is 60 degrees .
- 7) All interceptor/outfall manholes or manholes receiving a sanitary sewer force main discharge shall be internally lined with approved coating to prevent hydrogen sulfide corrosion. See Sewer Materials Section for approved coatings and specifications.

d. Installation Restrictions for Design

- 1) Extensions of sanitary sewer mains are to be to the farthest property line of the tract where necessary to serve adjoining properties with gravity sewer along natural drainage patterns. In all instances, plans shall show the total area in acres draining to the uppermost bounds of the tract on any established watercourse. Additional sewer extensions may be required if the Public Utilities Department determines adjacent property can be served from extensions from the proposed site.
- 2) The depth of sewer mains shall be great enough to serve adjoining property, allowing for sufficient grade on the service line. Lateral connections are to be into manhole barrels (not the cone section) or into the top quarter of sewer mains.
- 3) All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes in accordance with Details S-31 and S-32. Taps can only be made by using a mechanical tapping machine or other approved device. All sanitary sewer service connections 6 inches and larger shall be made into manholes only. On mains 15 inches and larger, service connections are allowed only at manholes. Service clean-outs shall be located at the right-of-way line or the easement boundary line. The maximum vertical drop for a 6-inch service into a manhole shall be 10 feet. Four inch sanitary sewer services shall have no maximum vertical drop.
- 4) All sewer mains in traffic areas shall have a minimum cover of 5 feet measured from finished grade in traffic areas to the pipe crown unless ductile iron pipe is provided in Class I bedding where minimum cover shall be three feet. Sewer mains and services shall be no deeper than 12 feet unless approved by the Public Utilities Director. For installations deeper than 12 feet ductile iron shall be

used for mains and services, provided that cast iron may also be used for 4" services. Four inch service "stacks" may be PVC regardless of depth. Mains and services in non-traffic areas shall have a minimum cover of 3 feet (measured from top of finished grade) to the pipe crown. Service laterals shall be of PVC, or ductile iron when installed in a public right-of-way. If the sewer lateral goes into a manhole within an easement, it may be constructed of PVC material. A clean-out is required at the easement or right-of-way line and must be constructed out of ductile iron pipe or if PVC is used then it must be equipped with a bronze clean-out plug to facilitate location if buried.

- 5) Private collection systems installed outside of public easements and rights-of-way will be built to the applicable State Plumbing Code and Department of Health and Natural Resources Standards and must meet the requirements of the Public Utilities Department's Private Sewer System Standards.
- 6) The placement of fill dirt around and over existing sanitary sewer mains above the pre-existing ground elevation is prohibited and may only be approved upon written request to the Public Utilities Director. It is illegal to damage, cover or bury a sanitary sewer manhole of the City of Raleigh. When approved, fill must be compacted under, beside and above the sanitary sewer main to 95% compaction. Slopes may not exceed two-to-one and sufficient points for cross drainage must be provided.
- 7) Pressure sewer services are prohibited except in existing pressure sewer collections system area's or by specific approval of the Public Utilities Director.

e. Pump Stations

- 1) The City of Raleigh's policy is to utilize gravity sewer extensions to provide sewer services to all corporate properties within the City's service area, the ETJ, and the corporate limits. Therefore sewer pump stations are prohibited and may only be approved by a special written request to the Public Utilities Director. The engineer for the project shall address the following factors in considering a pump station and force main. Also see Details S-35 thru S-37.
- 2) The engineer shall evaluate the capacity of the receiving sewer main at the point of discharge and downstream to determine that the system can handle the transferred sewer flow.
- 3) The engineer shall perform a cost analysis of the pump system with appurtenances and gravity system. The gravity system must be at least 2.5 times more expensive for the City to consider a pump station.

- 4) The engineer shall size the pump station to accommodate the total basin area that could gravity flow into it.
- 5) In some circumstances, the Public Utilities Department may choose to accept for permanent ownership and maintenance pump stations designed in accordance with the City Standards. Those stations suitable for acceptance by the Public Utilities Department must meet the following criteria:
 - (a) Be determined by the Public Utilities Director to be in the "best interest" of the City.
 - (b) Be necessary due to limitations imposed by existing Public Utilities facilities.
- 6) **General Conditions for a Pump Station**
 - (a) A dedicated and recorded driveway access easement to the pump station shall be obtained and shown on the as-built plans. In the case of phased development, future access shall also be addressed. Plan and elevation drawings of all access roads shall be shown on the plans prior to approval.
 - (b) The contractor/developer shall be responsible for obtaining all permits and payment of all fees for construction.
 - (c) The contractor/developer shall be responsible for establishing an account, payment of fees and connection of all utilities. The contractor/developer shall bear all associated utility costs until the date of final acceptance at which time the City shall assume these accounts and future costs.
 - (d) Pump Station driveways must be a minimum 12 feet wide with gravel 12 inches thick for the first 20 feet off the roadway and 6 inches thereafter, with curb cut and apron if on curbed street, and not greater than 10 % slope. A vehicle turnaround area at the pump station shall be provided. The City reserves the right to require concrete or asphalt paving of driveways. Sites with odor control chemical tanks must be accessible by 18 wheel tanker trucks.
 - (e) A diesel fueled standby electrical generator in a weatherproof enclosure with automatic start and transfer of load with capacity sufficient to sequentially start and run all pumps and equipment shall be provided.
 - (f) The engineer shall address the potential for odor at all sites. Odor control shall be required at all pump stations with force mains greater than 2,500 feet, unless exempted by the Public Utilities Director.

- (g) Remote monitoring equipment as required by the City shall be provided. The engineer shall be responsible for a radio site survey of the proposed pump station site to ensure compatibility with the City's existing system before submitting plans for final approval. The contractor shall be responsible for providing all equipment including RTU's, PLC's, antennas, antenna pole, etc. This system will send and receive data using the existing telemetry network owned and operated by the City of Raleigh. The contractor is required to purchase the RTU SCADA cabinet from the Public Utilities Department. The contractor shall be required to provide the Wonderware HMI programming at the main server and the testing of all communication points.
- (h) Pump stations shall have 100% reserve peak pumping capacity (dual pumps) and shall be either the wet well/dry well type or the vertical suction-lift type unless specific approval is granted by the Public Utilities Director for use of other type pumps. Detailed engineering plans will need to be approved by the Public Utilities Director prior to construction.
- (i) Force mains shall be made of ductile iron in accordance with the Water Materials Section of these specifications and installed under the same construction specifications as water mains. Force mains shall include a gate valve ten feet outside of the station but inside the fence and an air release valve at all high points. Force mains shall convert to gravity flow at a point where they can reasonably do so. The engineer shall provide calculations to confirm that a surge relief valve is not needed. Force main size and discharge point shall be shown on the as built plans.
- (j) Prior to the station being placed into service private pump stations shall be equipped with a sign indicating a 24-hour on call service number, the current owner and the responsible party.
- (k) Start-up services will be required for all equipment and must be performed by a qualified factory representative. A copy of all start-up reports will be due before final pump station acceptance.
- (l) On-site training by a qualified factory representative is required for all equipment.
- (m) An eight foot high green vinyl coated galvanized steel chain link fence with green privacy slats for restricted access to the site and equipment with a twelve foot wide double- leaf access gate is required at all sites. Wire gauge shall be No. 9 minimum with 2 ½ inch minimum OD vinyl coated posts and 1 5/8 inch minimum OD vinyl coated top rails. Corner posts shall be 3 inch minimum OD vinyl

coated and gate posts shall be 4 inch minimum OD vinyl coated. Fence shall be no less than 10' from property/easement line.

- (n) A potable water source with freeze proof yard hydrant shall be provided at site. A 24 inch square concrete pad shall be installed at the base of the yard hydrant. This must be a metered water service from the City of Raleigh unless approved otherwise by the Public Utilities Director.
- (o) Backflow prevention devices shall be provided for the water source per City of Raleigh standards. The unit shall be housed in a heated fiberglass enclosure, above grade. All backflow prevention devices are to be tested by installer and copy of test results provided at final inspection.
- (p) Warranty on all equipment shall commence when the City accepts the pump station for operation.
- (q) All sewer force main valve box caps must be marked SEWER.
- (r) The contractor shall provide the owner with a minimum of three sets of operating and maintenance manuals for all equipment. Manuals must be original as provided by the manufacturer and bound. Spare parts as required by the City of Raleigh shall be boxed for long term storage with part numbers and identification labels. Items subject to handling damage will not be accepted if factory packaging has been opened. All manuals and spare parts are to be turned over at final inspection and acceptance of the pump station.
- (s) A screened vent shall be provided for the wet well. The vent shall be sized by the engineer for the wet well and installed so that gases are directed away from equipment. The vent shall be 4" min. size and supplied with a stainless steel insect screen.
- (t) An aluminum panel backboard and weather hood mounted on galvanized posts with concrete standing pad is required for electric service and telemetry equipment. The weather hood shall be equipped with work lights and a convenience receptacle with weatherproof covers.
- (u) Wet well components must be located such that normal maintenance can be performed without having to physically enter the wet well.
- (v) The site shall have a minimum of one overhead area light with switch and photocell. Weather hoods over panels shall be provided with lights.

- (w) All bolts, mounting brackets, pump lifting chains, etc., shall be of proper corrosion resistance and sized and mounted to support applicable loads.
- (x) New installations are required to meet the latest revised OSHA standards at the time of final acceptance. The contractor shall provide and install all site specific OSHA required labels and signs for the site.
- (y) The pump station shall have a high wet well alarm in the form of a horn and a light beacon. The horn shall be capable of being silenced through the telemetry system. The alarm light shall be red and mounted so as to be visible in a 360 degree radius.
- (z) The pump station shall be located one foot above the 100-year flood elevation. 100 year flood elevations shall be shown on the plans.
- (aa) All wet wells shall be internally factory lined with one coat of a 20% solids, deeply penetrating, dual-component polyurea primer (.5-1.0 mils dry film thickness, 150 ft²/gal), one intermediate coat of a dual component polyurea (50-100 mils dry film thickness, 50 ft²/gal) and one top coat of a 65% solids, two-part polyurea (7.5-10 mils dry film thickness, 125 ft²/gal). All coats shall be applied by brush, spray, or roller. Polyurea coatings shall be Duramer 1030 as manufactured by SewerKote, or approved equal.
- (bb) Landscaping shall be provided in accordance with the City landscaping ordinance.
- (cc) Pump station components that are submitted for installation are to be the latest models by City approved manufacturers.
- (dd) "As Built" plans, digital and paper of the pump station, access easement, force main indicating discharge point, all valves and air releases in force main, and initial float elevation settings must go to the City of Raleigh Public Works Department and the Public Utilities Department.
- (ee) The engineer or contractor shall forward shop drawing submittals for the generator, transfer switch, and package pump station to the City of Raleigh Public Utilities Department for review.
- (ff) Pump Stations will not be allowed to discharge to another pump station under any circumstance.
- (gg) Site visits by City personnel will be required and scheduled as follows;
 - 1. Before final plan approval,
 - 2. When pumps are set,

3. Pump and generator startup testing,
4. Final Inspection, and when flow is applied and station is ready for service.

3) **Requirements for Pump Station Pumps**

- (a) Multiple pumps (minimum of 2) each capable of pumping at a rate of 2.5 times the average daily flow rate with any one pump out of service. Pump-on/Pump-off elevations shall be set such that 2-8 pumping cycles per hour may be achieved in the pump station at average flow.
- (b) A spare rotating assembly consisting of impeller, key, nut, washer, and mechanical seal shall be included with each pump. A spare impeller, key, nut, and washer of opposite rotation than assembly shall also be furnished.
- (c) A spare electric pump motor shall be provided with the pump station.
- (d) The pumps must be equipped at a minimum with dry contacts for SCADA purposes indicating run time, O/L tripped, pump breaker tripped, priming failure, lag pump start, high wet well, three phase power fail and control power fail for remote telemetry purposes.

4) **Requirements for Pump Station Permanent Standby Generators.**

- (a) The generators shall be sized to sequentially start all pumps and operate all equipment at the site.
- (b) The generators shall be equipped with an automatic transfer switch to start generator and transfer load to emergency in case of utility under-voltage, over-voltage, power loss, phase reversal, or phase loss.
- (c) There shall be a fuel tank with the capacity to run the generator a minimum of 24 hours with a 100% load. Fuel tanks shall be UL listed double wall with leak detection. Low fuel and leak detection status shall be available both at the site and through the SCADA.
- (d) At time of acceptance of operation by the City of Raleigh, the contractor shall be responsible for topping off the fuel tank.
- (e) The generators shall be equipped with a 304 stainless steel (including all internal components), critical grade exhaust silencer. The silencer shall be equipped with a rain cap and all connections, pipes, nuts, bolts, etc., which shall be 316 stainless steel.
- (f) There shall be dry contacts provided to indicate engine run, common engine fail, common engine warning, transfer switch position, utility

power loss, low fuel level, and fuel tank leak for remote telemetry purposes. More items may also be required based upon the site.

- (g) The owner shall be furnished with one complete set of spare air, oil, and fuel filters for the generator. The owner shall also be furnished with one set of spare accessory belts.
- (h) The owner shall be given three copies of the O&M and parts manuals specific for the generator unit and the automatic transfer switch.
- (i) The automatic transfer switch shall have a disconnect on the utility service main side.
- (j) The generator set, controls, and transfer switch shall be furnished by a single supplier. The supplier shall be the authorized dealer of the engine-generator set manufacturer and shall be fully qualified and authorized to provide service and parts for the engine and generator at any time during the day or night. The supplier must be located within a 100 mile radius of the site.

5) **Electrical requirements for the pump station**

- (a) All electrical work shall conform to the latest NEC and local guidelines.
- (b) Control panels shall be so labeled as an assembled panel and bear the UL label.
- (c) Sewage pump station utility voltage shall be 480 volt three phase power.
- (d) All wiring shall be identified at each termination. Wiring shall have a unique wire number and shall be labeled at both ends. Wire numbers shall correspond with equipment terminal wire numbers as indicated in the accepted shop drawings. Where no wire numbers are indicated, the contractor shall advise the engineer in writing prior to assigning wire numbers. Wire numbers shall not be duplicated.
- (e) For instrumentation wiring, the contractor shall provide on the shop drawings, a schedule indicating the wire number, color code if applicable, origin and destination devices, and terminals.
- (f) Conductor insulation color coding: (Tape for identification shall only be allowed on conductors larger than #6 AWG.)

480 Volt AC Power:

Phase A – Brown
Phase B – Orange

Phase C – Yellow
Neutral – White

120/208 Volt or 120/240 Volt Power

Phase A – Black
Phase B – Red
Phase C – Blue
Neutral – White

DC Power

Positive Lead – Red
Negative Lead – Black

DC Control

All Wiring – Blue

120 VAC Control

Single conductor 120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This conductor shall be color coded YELLOW.

240 VAC Control

All wiring – ORANGE

Equipment Grounding Conductor

All wiring - Green

- (g) Phase sequence shall be A-B-C from rear to front, top to bottom, or left to right when facing the equipment.
- (h) The use of rigid hot-dipped galvanized steel or rigid aluminum electrical conduit is required. The contractor shall apply a section of heat shrink tubing to the conduit extending through and 12" above and below concrete pads.
- (i) All panels shall be lockable and rated NEMA 4X minimum.
- (j) Weatherproof, insulated throat "Meyers" hubs shall be used on all conduit entries to panels, boxes, and devices without integral hubs.
- (k) All equipment shall be NEMA rated, IEC will not be accepted.

- (l) All electrical and control panels shall have weatherproof identifying labels attached with stainless steel screws, adhesive will not be acceptable.
- (m) All electrical conduit from wet well to control panel must be sealed to prevent gas entry to control panel or pump house enclosure. This only applies to conduit that enters the wet well area.
- (n) No electrical junction boxes or splices are permitted in the wet well.
- (o) All branch circuit panels shall have a typed index identifying breakers. Spare breakers are to be labeled "spare."
- (p) The owner shall be provided one complete set of spare fuses.
- (q) Conduit size, origin, destination, wire size and number of wires shall be shown on the plans.

CITY OF RALEIGH, BASIC TWO PUMP SEWAGE LIFT STATION MONITOR POINTS

DATA TYPE	DEFINITION	CONTROL HOOKUP
DI	CONTROL AC POWER FAIL	DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF CONTROL CIRCUIT PROTECTED BY PHASE MONITOR THAT BREAKS CONTROL CIRCUIT
DI	HIGH WETWELL	DRY CONTACT ON HIGH WETWELL RELAY AND SEPARATE DIRECT FLOAT
DI	PUMP 1 BREAKER TRIPPED	DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF BREAKER OR INTERNAL TO BREAKER
DI	PUMP 2 BREAKER TRIPPED	DRY CONTACT ON RELAY POWERED BY LOAD SIDE OF BREAKER OR INTERNAL TO BREAKER
DI	PUMP 1 O/L TRIPPED	AUX. DRY CONTRACT ON O/L
DI	PUMP 2 O/L TRIPPED	AUX. DRY CONTRACT ON O/L
DI	PUMP 1 RUNNING	AUX. DRY CONTACT ON MOTOR STARTER
DI	PUMP 2 RUNNING	AUX. DRY CONTACT ON MOTOR STARTER
DI	PUMP 1 PRIME FAIL	DRY CONTACT, MANUFACTURER PROVIDED
DI	PUMP 2 PRIME FAIL	DRY CONTACT, MANUFACTURER PROVIDED
DI	LAG PUMP RUNNING	DRY CONTACT, MANUFACTURER PROVIDED
DI	PM VISIT	ON DOOR OF RTU OR MOUNTED SWITCH
DI	GEN. RUN & HOUR METER	DRY CONTACT GENERATOR RUN RELAY
DI	GEN. FAIL, COMMON FAULT	DRY CONTACT COMMON FAULT RELAY
DI	GEN. WARNING, COMMON FAULT	DRY CONTACT COMMON WARNING RELAY
DI	TRX SWITCH EMERG/UTILITY POSITION	DRY CONTACT, TRX. SWITCH
DI	TRX SWITCH UTILITY POWER AVAILABLE	DRY CONTACT, TRX. SWITCH
DI	GEN. FUEL LOW	DRY CONTACT, MANUFACTURER PROVIDED
DI	GEN. FUEL TANK LEAK	DRY CONTACT, MANUFACTURER PROVIDED
DO	HIGH WETWELL HORN SILENCE	RELAY TO SILENCE ALARM HORN, NEEDS SCRIPT IN SCADA TO RESET AFTER 1 HOUR

Alarm wiring to be # 14 stranded MTW blue color. Pull alarm wiring in separate conduit from AC power circuits. Conduit size for alarm circuits to be min.1" from PS control to RTU, 1" from generator to RTU and ¾" from ATS to RTU.

These are basic points; site specific points will need to be addressed.

CITY OF RALEIGH, NEW SEWAGE PUMP STATION CHECKLIST

SITE:

THIS MUST BE COMPLETED IN FULL BEFORE CITY OF RALEIGH WILL ASSUME OPERATION AND MAINTENANCE OF SITE.

DATE	ITEM	COMMENTS	INITIAL
	AS BUILT PLANS PS & FORCE MAIN	NOTE 1	
	O&M MANUALS PS	NOTE 2	
	O&M MANUALS GEN. & TRANSFER SWITCH	NOTE 2	
	O&M MANUALS CHEMICAL FEED	NOTE 2	
	O&M MANUALS AIR RELEASE VALVES	NOTE 2	
	SPARE PARTS PUMP STATION	NOTE 3	
	SPARE PARTS GENERATOR	NOTE 4	
	SPARE PARTS FUSES	NOTE 6	
	RPZ TEST REPORT		
	GENERATOR START-UP TEST REPORT		
	PS START-UP TEST REPORT		
	CHEMICAL FEED START-UP TEST REPORT		
	SITE ADDRESS		
	KEYS, ELEC PANELS, GENERATOR, ETC.	NOTE 7	
	UTILITY BILLING ELECTRICAL SERVICE	NOTE 5	
	UTILITY BILLING WATER SERVICE	NOTE 5	

NOTES:

1. Provide 1 hard paper, 1 digital on CD
2. Provide 3 copies O&M, original and bound
3. Provide 1 pump motor, 1 rotating assembly consisting of CW impeller and seal.
Provide 1 CCW impeller key, nut and washer, 1 mechanical seal, gaskets
4. Provide 1 set belts and air, fuel and oil filters
5. Provide account info, so City can assume account
6. Provide 1 complete set of each type and size used
7. Provide 3 minimum

g. Oil and Grease Traps

- 1) All food preparation establishments shall have devices installed for separating and retaining oils and grease known as grease traps or grease interceptors approved by the Public Utilities Department. Operators of establishments whose grease traps or interceptors are not adequately maintained to prevent floatable oils, fats, and grease from entering the sanitary sewer system shall be notified in writing of any noncompliance and required to take corrective action.
- 2) All food preparation establishment grease traps or interceptors shall be subject to review, evaluation, and inspection by City of Raleigh Public Utilities representatives.
- 3) Food preparation establishment operators who continue to violate the City of Raleigh grease program requirements will be subject to enforcement provisions of the Raleigh City Code.
- 4) Food preparation establishment operators whose operations cause or allow excessive grease to discharge or accumulate in the City of Raleigh sanitary sewer collection system may be liable to the City of Raleigh for costs related to line blockages, line cleanings, line and pump repairs, etc., including all labor, materials, and equipment. Food preparation establishment operators that fail to pay the related charges will be subject to enforcement provisions of the Raleigh City Code.
- 5) Regularly scheduled maintenance of grease-handling facilities and equipment is required to ensure adequate operation. All outdoor grease traps and under the sink grease traps shall be completely pumped out at a minimum frequency of once per thirty calendar days and once per seven calendar days respectively, unless a pretreatment permit has been issued specifically for these devices requiring more frequent pump-outs.
- 6) The owner and/or leaseholder shall be responsible for ensuring that no waste or wastewater pumped from the grease trap or interceptor is reintroduced back into the device. This is a violation of the City of Raleigh Sanitary Sewer Use Ordinance and will result in enforcement action.
- 7) Any food preparation establishment whose grease trap or interceptor effluent discharges to the sanitary sewer collection system is determined by the City of Raleigh to cause interference in the conveyance or operation of the sanitary sewer collection system may be required to sample its grease trap discharge and have it analyzed for oil and grease at the expense of the owner and leaseholder. Results of such analyses shall be reported to the City of Raleigh Public Utilities Department.

- 8) All grease trap or interceptors shall be designed and installed to allow for complete access for inspection and maintenance of the inner chamber(s) and sampling of effluent wastewater discharged to the sanitary sewer.

- 9) Standards for New Facilities:

All new food preparation facilities shall be required to install an adequately sized grease trap. Below are the recommended sizing procedures. Other sizing criteria may be considered but should be justified. Variances to the tank size requirements may also be considered upon request (see Variance Procedures below).

Sizing Procedure for Food Service Establishments (FPE)

Minimum of 1000 Gallons

meals/peak hour x waste flow x retention time x storage factor =
minimum trap volume

In many cases the # meals = # of seats, however, situations may exist where other determinations of peak meals may be appropriate.

waste flow = 2.0 w/ single service, 5.0 w/o dishwasher, 6.0 w/
dishwasher.

retention time = 2.5 hours for commercial kitchens and 1.5 hours for
single service.

storage factor = 8hr-1, 16hrs-2, and 24 hrs-3, single service
kitchen=1.5

Sizing Procedure for Single Fixture Only

A single fixture is considered a utensil wash sink, prep sink, culinary sink or other fixture where wastewater is discharged through a single outlet that contains fats, grease or oils.

- Step 1** Determine the cubic contents of the fixture by multiplying length x width x depth.
- Step 2** Determine the capacity in gallons. 1 gallon = 231 cubic inches.
- Step 3** Determine the actual drainage load. The fixture is usually filled to about 75 percent of capacity with wastewater. The items to be washed displace about 25 percent of the fixture content. Actual drainage load = .75 x (fixture capacity)

- Step 4** Calculate the flow rate in GPM equal to or greater than 75 percent of the fixture capacity.
- Step 5** Select the grease separation device that matches the calculated design flow rate.

- (a) No new food preparation establishment will be allowed to discharge wastewater to the City's collection system until an adequately sized grease trap or interceptor is installed and approved by the Public Utilities Department.
- (b) All grease traps must have each chamber directly accessible from the surface for servicing and maintaining the trap.
- (c) A basket, screen, trap, or other intercepting device shall prevent passage into the drainage system of solids one-half (1/2) inch or larger in size. The basket or device shall be removable for cleaning purposes.
- (d) All fixtures and drains receiving kitchen or food preparation wastewater shall pass through a grease trap or interceptor.

10) Standards for Existing Facilities:

- (a) All existing food preparation facilities shall have grease traps or interceptors approved by the Public Utilities Director. Food Preparation facilities without a grease trap or interceptor will be given a compliance deadline of six months from date of notification to have approved and installed a grease trap or interceptor. Failure to do so will be considered a violation of the City of Raleigh Sanitary Sewer Use Ordinance and may subject the facility to penalty assessments and/or service termination.
- (b) Existing food preparation establishments that are expanding the occupant load by 50% or more or proposing a significant change in the wastewater characteristics are required to resize the grease trap in accordance with the procedures established under standard specification section G.9.a.
- (c) In the event an existing food preparation facility's grease trap or interceptor is either undersized or substandard in accordance with this ordinance, the owner and/or leaseholder will be notified of the deficiencies and required improvements, and given a compliance deadline of six months to conform to the requirements of this Ordinance. Failure to do so will be considered a violation of the City of Raleigh Sanitary Sewer Use Ordinance and may subject the facility to penalty assessments and/or service termination.

- (d) For cases in which outdoor in-ground grease traps are infeasible to install, existing food preparation establishments will be required to install adequate under the sink grease traps approved by the Public Utilities Department for use on individual fixtures including dishwashers, sinks, and other fixtures and drains that potentially contain grease (See specifications section G.9.a. "Sizing Procedure for Single Fixture Only" above).
- (e) Sizing of grease traps shall be determined in accordance with procedures under specification section G.9.a.
- (f) The exclusive use of enzymes, emulsifiers, etc., is not considered an acceptable grease trap maintenance practice.

11) Maintenance, Reporting & Record Keeping

- (a) Maintenance records must be retained for review by City Inspectors and must include: Date of Maintenance, Maintainer's Name, and Method of Disposal by the Maintainer. Maintenance records shall be kept onsite where the grease trap or interceptor is located for a period of three years.
- (b) Facilities for which a specific pretreatment permit has been issued will follow the requirements for maintenance and record keeping as stated in the permit.

12) Variance to Scheduled Maintenance or Tank Sizing Requirements

- (a) A variance to the scheduled maintenance or tank sizing requirements of the City of Raleigh Public Utilities Department's FOG (Fats, Oils and Grease) specifications is to provide specific changes to the scheduling of grease separation device maintenance and servicing or the results from the recommended grease trap or interceptor sizing. Said variance is intended to give food service establishments an avenue to provide substantial evidence to reducing maintenance or size of the grease separation device. Said variance only applies to the scheduling of grease separation device servicing or grease trap/interceptor sizing. All other requirements of the City of Raleigh Sanitary Sewer Use Ordinance, FOG Control Ordinance, and any other requirements remain in effect.
- (b) Food service establishments shall provide a written explanation for the need to vary from the FOG Control Ordinance. All establishments requesting a variance shall agree to conform to the given variance stipulations. The City

of Raleigh Public Utilities Department has the right to dismiss the variance at any time the grease separation device discharge adversely affects the sanitary sewer collection system and treatment works. Correspondence from the Public Utilities Department must be obtained prior to plan submittal for a building permit.

The variances request shall be made to the City of Raleigh Public Utilities Department regarding size and shall include at a minimum;

New Facilities

Applicant name and address, facility location, menu items, seating capacity, facility square footage, appliance/fixture inventory, service type (single or full service), hours of operation, general plumbing description and site plan or description.

Existing Facilities

Variances will only be granted to existing facilities that have been operating in compliance free of Notices of Violation or Noncompliance for at least the previous twelve (12) months. Requests must include; applicant name and address, physical location, menu items, seating capacity, facility square footage, appliance/fixture inventory, service type (single or full service), hours of operation, general plumbing description and site plan or description, and a summary of past maintenance activities. In addition, all variance requests must include a detailed future operation and maintenance plan that identifies the operational constraints, maintenance schedule and oil and grease waste disposal procedures.

2. SEWER DESIGN – PRIVATE

Private sewer collection systems with a flow rate of 200,000 GPD or more must apply to the NC Division of Water Quality for an operating permit. Private sewer collection systems located within the Raleigh Utility Service Area and proposed for connection to the City's public system now or in the future shall conform to all the public system standards listed within this document with the following conditions:

- a. Private sewer collection lines shall not be required to be located in public road right-of-way or publicly dedicated easements.
- b. Change of direction or slope for private 6-inch sewers does not require manholes but does require cleanouts.

- c. Cleanouts shall not be used for connection of private collections systems to public mains. Manholes are required.
- d. Private sewers shall not be sized to handle any off-site sewer flows.
- e. Ductile iron or PVC must be used with a minimum diameter of 6-inches.
- f. Profile drawings will not be required for 6 inch lines however, equivalent information must be provided on detail engineering plans such as minimum depth of cover, culvert elevations, slope, length of reach between manholes/cleanouts, pipe material, vertical separation of sewer from conflicting water main or storm drainage, etc. Profile drawings will be required for main sizes of 8 inch and larger. The minimum slope for 6" lines is 0.5%. Flow will be based on a half full pipe.
- g. All aerial sewer services shall be constructed of ductile iron pipe.

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REUSE DESIGN STANDARDS

Unless otherwise indicated, all standards apply to both the public and private reuse systems. Described in this section are the general design standards, which are to be followed by all parties in preparing subdivision, utility extension, and utility replacement plans for the City of Raleigh. These design standards will ensure that the citizens of Raleigh will have a safe, reliable, and quality reuse water system. Reuse water service is subject to the availability and capacity of facilities, as determined by the City. The City shall control and schedule availability of reuse water.

All engineering plans for public and private reuse systems must meet State and City minimum design standards as indicated in the most recent amended North Carolina Administrative Code Title 15A Subchapter 2H Section .0200 by the N.C. Department of Environment and Natural Resources, Division of Water Quality and/or this City of Raleigh Public Utilities Department Handbook, whichever is the more stringent. All projects must be certified by the engineer of record or the City Engineer. The engineer shall be responsible for determining the reuse water pressure at the point of connection and adequacy for services at the highest point of the project. Reuse water pressure information is available from the Public Utilities Administrative office.

Plan and profile drawings shall be prepared by a professional engineer registered in the State of North Carolina, signed, sealed, and dated showing the various elements of the utility mains and shall include an overall utility plan layout on a single sheet with scale no smaller than 1 inch = 200 feet. The design of improvements must be based upon actual field verification by the engineer of existing utilities. The utility drawings shall be on separate sheets, free of landscaping and other details not pertinent to the utility plans. A separate landscaping plan must be submitted with the utility plan showing any proposed landscaping and all water, sewer, and reuse utilities or easement. All adjacent tracts and topographic information must be shown on the landscaping plan. The water, sewer, and reuse drawings may be on the same sheets. Landscaping plans shall show all utility engineering drawings and shall be on paper 24 inches by 36 inches.

Once installed, certified surveyed “as built “ plans shall be provided to the City showing the utilities. “As built” drawings for the utilities shall be submitted to the Public Works Department prior to acceptance of the project by the City.

1. REUSE DESIGN – PUBLIC

A. Location Conditions for Design

- 1) All reuse mains shall be installed within dedicated street rights—of-way except major transmission mains not affording direct service connection or within City of Raleigh dedicated reuse easements. Reuse mains within the street right-of-way shall be a minimum of 5 feet from the outside of the pipe to the edge of the right-of-way. Greater separation may be required for greater depth. Reuse mains as specified by the City of Raleigh will be marked as indicated on Standard Water Detail W-13 and as described under the Reuse

Design Identification section (Section V.A.1.g). The City reserves the right to determine the location of reuse service lines.

- 2) Minimum widths of permanent and construction reuse easements, for public reuse mains are 20' each.

Larger size easements may be required based upon the depth of installation or other consideration as determined by the Public Utilities Department and Engineering Department. Reuse mains shall be centered in the easement. All reuse easement boundaries must be field staked and flagged by the developer's surveyor and at the developer's expense.

- 3) The minimum easement width for reuse is 20 feet and may not include any other utility. Such easements are to be recorded as "City of Raleigh Reuse Easement".
- 4) All off-site easements shall be acquired by the developer. These off-site easements shall be recorded by map and by deed of easement prior to construction approval. The easements shall be dedicated to the City of Raleigh and entitled "City of Raleigh Reuse Easement".
- 5) No permanent structures or impoundments shall be constructed on water mains, water transmission mains or within reuse water easements.

B. Main Size

- 1) Major mains shall be sized according to the Reuse Water System Master Plan and/or City of Raleigh Public Utilities Director. The City reserves the right to determine the size of reuse service lines.
- 2) The minimum size reuse main shall be four inches unless dictated otherwise by sound engineering and approved by the Public Utilities Department prior to construction.
- 3) The City of Raleigh is required to provide a minimum pressure of 25 pounds per square inch (psi). If an individual needs greater pressure, then it is his/her responsibility to incorporate the necessary booster pumping facilities.

C. Fire Hydrants

The installation of fire hydrants on the reuse system for public or private use is prohibited.

D. Valves

- 1) Each proposed new intersection shall have a main line valve for every leg, i.e., a four-way intersection shall have four main line valves and a TEE intersection shall have three main line valves. All valves shall be rodde to a tee or cross in accordance with Standard Water Detail W-15.
- 2) Mains twelve inches and larger in diameter that have a change in elevation of fifteen feet or greater shall have an air release valve installed at the highest elevation of such change, as per Standard Water Detail W-19. Additional air release valves may be required by the Public Utilities Director on mains less than 12-inches based on elevation changes of 15 feet or greater.
- 3) Pressure reducing and/or sustaining stations shall be installed when directed by the Public Utilities Director to connect high and low pressure systems. The pressure reducing valve shall allow enough flow from the high side to maintain a specified pressure on the low side and will not reduce the high side below a certain amount. This type valve will be a pressure sustaining/ pressure reducing valve.
- 4) All reuse valves and appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in Section V.A.1.g of these specifications.

E. Meters

- 1) All reuse services will be metered, and the meter will be located in the rights-of-way or in a 2-foot easement adjacent to the rights-of-way. In no case shall meters be located inside of buildings. The City will maintain all reuse connections within the street right-of-way at no charge to the property owner. Repairs on private property shall be the responsibility of the property owner or customer.
- 2) All meters will be furnished and set by the Meters Division once all fees are paid and accounts have been set up. Meter installation and spacing shall be in accordance with applicable Standard Water Details W-23 through W-34.
- 3) All reuse meters and appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in Section V.A.1.g of these specifications.
- 4) A master meter should be used if the building permit and plat show single ownership and a single lot. If a building is sold from the complex, then it will require a separate reuse service, with an individual meter with those services originating from a City maintained reuse main.

F. Reuse Backflow/Cross Connection

- 1) The Public Utilities Director may require an approved backflow prevention assembly for any existing or proposed reuse services, dedicated irrigation lines, or private distribution systems. Questions concerning Raleigh's Backflow/Cross-Connection Prevention Program should be directed to the Public Utilities Cross Connection Coordinator at (919) 870-2897.
- 2) In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container.
- 3) On reuse service lines serving a facility that is in operation continuously, the lines must have parallel backflow prevention assemblies on a single service line or adequate protection on each supply line to that facility. On parallel installations each assembly must be the same type (two double check valve assemblies, two double detector check valve assemblies, two reduced pressure zone device assemblies, or two reduced pressure zone detector check assemblies). In some cases, these assemblies must be the same size as the service line. The rule to normally use in this situation is that the assembly must have the square of the diameters equal to the square of the supply service "tap". For example, an 8-in service line would need, at a minimum, two 6-in devices in parallel.
- 4) The Public Utilities Department approved backflow prevention assemblies shall be installed above ground. Assemblies may be installed inside of buildings as long as there are no unprotected taps between the main and the building. The minimum drain size in an aboveground vault for double check assemblies and double detector check valves is 4 inches. An approved dual check valve must be installed at the meter service on single family residential service lines. OS&Y shut-off valves shall be used on all backflow prevention assemblies (2 ½" or larger) and each double check valve backflow preventer will have approved test cocks. Approved installations are shown on Standard Water Details W-34 through W-39.
- 5) All backflow prevention assemblies and appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in Section V.A.1.g of these specifications.

- 6) If the private distribution systems or domestic service lines are connected to any "processed water" sources or booster pump system, backflow protection shall be provided by using the USC-approved Reduced Pressure principle zone assembly (RP) type assembly. "Processed water" is water where extra chemicals are added by the user onsite to reduce freezing, pipe corrosion, etc. This RP assembly shall include the resilient wedge valves and test cocks, and the RP unit shall meet the requirements of the latest AWWA Standard C-506-78. If the RP assembly is 2½" or larger, then it must be supplied with OS&Y shut-off valves. The unit shall be housed in an aboveground vault, insulated aboveground enclosure, or inside of a building. No RP's may be installed below ground.
- 7) If the backflow preventer is located onsite, then it shall be located outside the structure that it is serving unless otherwise approved by the Public Utilities Department. If there are no unprotected taps between the street and building, it can be located in the building. All internal or confinement assemblies (isolation assemblies) will have strainers upstream of the device.
- 8) No person shall fill special use tanks or tankers containing pesticides, fertilizers, or other toxic chemicals or their residues from a public reuse system except at a location equipped with an approved air gap (2 X diameter of supply pipe with a minimum gap of 1") or an approved reduced pressure backflow preventer properly installed on the public reuse supply. No supplier of water shall permit the filling of such special use containers except at locations so equipped.
- 9) Backflow prevention assemblies shall be installed at a minimum height of 12 inches and a maximum height of 60 inches above the floor or ground. Assemblies shall also have a clear horizontal distance of 18 inches around the entire diameter of the device.
- 10) The backflow prevention assembly(s) must be readily accessible at all times. Readily accessible means that only a one-piece cover must be removed for an outside installation to test or perform maintenance to the assembly.
- 11) Defacing a backflow prevention assembly will not be allowed. Defacing would include anything that might obscure pertinent information on that assembly (i.e., nameplate, serial number, etc.). Any assembly that is missing a nametag or information stamped in the body will not be considered to be an acceptable assembly installation and must be replaced upon notification by the City.
- 12) Backflow prevention assemblies must be installed, tested, and maintained by persons that have completed the City of Raleigh Cross Connection School or other approved Cross Connection

School. It is also required that all assemblies be tested at the time of installation and annually thereafter. All assemblies must also have the rubber parts changed every five years.

The list of approved test equipment follows:

Mid-West Model	830 & 844
Watts	TK-DP, All assemblies
Watts	TK-99D
Pro-Master	RP Test kit

*Testing equipment shall be calibrated yearly.

All assemblies $\frac{3}{4}$ -inch through 2-inch must have a ball valve that is full port, a blow-out proof stem, resilient seats, and a 400-psi WOG (water, oil, or gas) rating. All assemblies 2 $\frac{1}{2}$ -inch through 10-inch must have fusion-bonded, epoxy-coated resilient wedge valve. All test cocks must be approved ball valves of the appropriate size.

- 13) In no case shall a connection be made between the potable and reuse water systems. Where both reuse and potable water are supplied, a reduced pressure principle device or an approved air gap separation shall be installed on the potable water service. If it is necessary to use potable water to supplement the reuse system, an approved air gap separation must be provided to protect the potable water system. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the overflow level of the container.
- 14) All backflow prevention assemblies installed outside of buildings must be installed in an approved enclosure with the exception of residential lawn irrigation backflow prevention assemblies. All enclosures shall be insulated and shall meet the requirements of ASSE standard 1060.
- 15) Double check valves and double detector check valves may be installed horizontally or vertically (see approved list at end of materials section). Reduced pressure backflow prevention assemblies shall be installed only horizontally.

G. Installation Restrictions for Design

- 1) All reuse mains, of proper size as determined by the Public Utilities Department, shall be installed complete, along all boundaries abutting existing public roadways, from property line to property line regardless of the land use, proposed lot arrangement of the subdivided property or the availability of connection to a main in

service. Within all dead-end streets that may be extended, the water main must extend to the property line of the subdivision.

- 2) All DIP reuse mains shall be installed with a minimum cover of 3 feet from the top of finished grade to pipe crown and shall be in accordance with all applicable City Standards. All PVC reuse mains shall be installed with a minimum cover of 4 feet from the top of finished grade to pipe crown and shall be in accordance with all applicable City Standards.
- 3) When mains are to be installed to a dead end, or mains are stubbed for future extension, at least one 18-foot joint of pipe, or more when required, shall be designed and fitted with a welded thrust collar in accordance with Standard Water Details W-7 through W-12, of these specifications. Blow-off assemblies shall be provided on all dead ends or as directed by the Public Utilities Director. In no case shall a blow-off assembly be installed such that the discharge would be to ground surface, drainage ditches, stormwater ponds, stormwater systems, or other non-treated systems. Blow-off assembly sizing shall match pipe sizing through 12-inch diameter. The blow-off for 24-inch and larger mains shall require approval by the Public Utilities Director. Blow-off assemblies shall be in accordance with Standard Reuse Details R-1 & R-2 of these specifications. Mains that are determined to be extended in the future must also terminate with a full-size main line gate valve prior to the last joint of pipe.

H. Identification

All reuse piping, valves, outlets, and other appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water.

- 1) All reuse piping and appurtenances shall be either colored purple (Pantone 522) and embossed or integrally stamped or marked "REUSE WATER - DO NOT DRINK" or be installed with a purple (Pantone 522) identification tape or polyethylene vinyl wrap. The warning shall be stamped on opposite sides of the pipe and repeated every 3 feet or less.
- 2) All reuse outlets shall be marked "REUSE WATER – DO NOT DRINK".
- 3) Identification tape shall be at least 3 inches wide and have white or black lettering on purple (Pantone 522) field stating "REUSE WATER - DO NOT DRINK". Identification tape shall be installed on top of reuse pipelines, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe.
- 4) Existing underground distribution systems retrofitted for the purpose of distributing reuse water shall be taped or otherwise identified as in 2) or 3) above. This identification need not extend the entire length

of the distribution system, but shall be incorporated within 10 feet of crossing any potable water supply line or sanitary sewer line.

2. REUSE DESIGN - PRIVATE

Private reuse distribution systems located within the Raleigh Utility Service Area and proposed for connection to the City's public system now or in the future shall conform to all the public system standards listed within this document with the following conditions:

- a. Private reuse distribution lines shall not be required to be located within public right-of-way or publicly dedicated easements.
- b. Private distribution systems located behind a master reuse meter will be built to the applicable State Plumbing Code and the Department of Human Services regulations.
- c. In no case shall aboveground hose bibs (spigots or other hand-operated connections) be installed on the private reuse system. Hose bibs for private reuse systems shall be installed downstream of the backflow preventer, in below-ground service boxes, lockable or designed to be operated with the use of a special tool, and clearly labeled "REUSE WATER – DO NOT DRINK".

A. Conversion to Reuse Service

When a user proposes the conversion of any existing potable water irrigation system to a reuse water irrigation system, a comprehensive investigation of the proposed reuse water system shall be performed for the City at the expense of the user. On a case-by-case basis, the City shall review the as-built drawings and other available records, and determine the measures necessary to bring the existing system into full compliance with the requirements of this Handbook. The City may deny issuance of a reuse water permit if the City determines that the proposed conversion cannot be safely made.

WATER MATERIAL STANDARDS

1. GENERAL MATERIAL REQUIREMENTS

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

Detail or shop drawings of fire hydrants, valves, air release valves, tapping sleeves and tapping saddles must be approved by the Public Utilities Department prior to installation.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. MATERIALS – WATER MAIN AND FITTINGS

a. Water Mains

All water mains shall be pressure class or thickness class ductile iron pipe designed in accordance with AWWA Standard C-150. Design shall be done for external and internal pressures separately, using the larger of the two for the next design thickness. An additional allowance shall be made for corrosion and casting tolerances. The thickness design for external and internal pressures shall use the following conditions:

- 1) 3 feet minimum cover or as shown on the plans;
- 2) Laying condition - Type 1;
- 3) A minimum working pressure of 150 psi for pipes 16 inches and smaller in diameter, and for 24 inches and larger pipe, the design working pressure shall be as determined by the Public Utilities Director, and
- 4) A surge pressure of 300 psi.

All calculations for thickness shall be in accordance with AWWA Standard C-150, and the calculations shall be submitted to the Public Utilities Director for approval prior to shipping any pipe. The minimum thickness shall be

pressure class 350 for pipes 6 inches through 12 inches and pressure class 250 for pipes 16 inches and larger in diameter.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C-151. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with AWWA Standard C-104. Ductile iron pipe shall be externally bituminous coated in accordance with AWWA C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with AWWA Standard C-111.

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, McWane Cast Iron Pipe Company or approved equal.

Restrained joints shall be TR Flex or Lok Tyte as manufactured by U.S. Pipe, Lok-Fast or Lok-Ring as manufactured by American Pipe, Super-Lock as manufactured by Clow, Bolt-lok or Rigid-lok as manufactured by Griffin or approved equal.

b. Fittings

All fittings shall be manufactured in accordance with AWWA C-110 or C-153 for ductile iron compact fittings. The fittings shall be tested and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be mechanical joint with the exception of certain above ground piping which may require flange fittings. Mechanical joints shall be manufactured in accordance with AWWA Standard C-111.

All fittings shall be cast iron or ductile iron and shall have a minimum working pressure rating of 250 psi and minimum iron strength of 30,000 psi.

All fitting interiors shall be cement-mortar lined with a sealcoat in accordance with AWWA Standard C-104, and the outside shall be bituminous coated.

Restrained mechanical glands may be used where restraint is needed except when welded restraining rings are required. Restrained mechanical glands provide additional restraint, but do not take the place of required concrete blocking.

Two (2) 45° bends shall be utilized for 90° turns of the water mains or branches. 90° bends are not allowed in the water distribution system.

c. Gate Valves

Cast iron or ductile iron resilient wedge style vertical or horizontal gate valves and tapping valves shall be used for all main line and hydrant branch valves in sizes from 6 inches through 24 inches. American, Mueller, Kennedy, AVK, Clow, M&H, and Waterous valves in accordance with AWWA C-509-94, C-515, or the appropriate AWWA standard as applicable, shall be used. All resilient wedge valves shall have internal and external epoxy coating, O-ring seals at the stuffing box and bonnett to body and dual O-rings at the stem seal above the thrust collar.

Tapping valves shall be the same valves as gate valves listed above, subject to the standards, providing that tapping valves shall have the tapping ring.

Gate valves twelve (12) inches in diameter and smaller, shall be mechanical joint or hub-end all-bell. They shall be "O" ring, open-left valves of the non-rising stem type. These valves shall be designed for a minimum of 175 psi working pressure and 300 psi hydrostatic test pressure with a two (2) inch operating nut. Valves shall be cast iron or ductile iron.

Valves sixteen (16) inches in diameter or greater may be the horizontal gate type or butterfly type, as specified on construction plans, or gate valves as specified above.

Gate valves, horizontal gate valves or butterfly valves shall be used for all main line and hydrant branch valves in sizes 16 inches through 24 inches.

d. Valve Boxes

Adjustable valve boxes shall be class 35 gray cast iron and manufactured in accordance with ASTM A48 and be of the dimensions specified in Detail W-17 of these specifications. Lids shall have the word "Water" cast into the lid. See Detail W-18. All castings must be domestically cast and so

indicated by the manufacturers name and "USA" cast into all sections of the valve box. All castings must meet or exceed AASHTO H-20 load rating. Total valve box weight shall be a minimum of 85 lbs and have a minimum lid weight of 25 lbs.

e. Butterfly Valves

Butterfly valves sixteen greater than (16) inches in diameter shall be Class 150B and shall conform to the latest AWWA Standards C-504, as manufactured by Mueller, Kennedy, Pratt, or American for rubber sealed butterfly valves and valve operating assemblies. "O" ring seals shall also be used exclusively with worm gear.

All valve end connections shall be mechanical joint or victaulic, as required by the detail drawings. Valve seats shall be stainless steel, bronze mating or resilient material. Resilient seat shall be mechanically attached to the valve disc, or mechanically retained in the valve body. Resilient seat shall be fully field adjustable by mechanical means. The valve disc shaft shall be stainless steel or either stub or thru-shaft design. Shafts shall be provided with two-way disc thrusters that are fully adjustable from the outside. Valve shaft bearings shall be heavy duty bronze, properly fitted into hubs integrally cast in the body of the valves.

All butterfly valve operators shall be worm gear type as manufactured by Philadelphia Gear Works or EPI. The valve operator shall be furnished with a two-inch square operating nut, and be so mounted that the valve will open-left (counter-clockwise). The butterfly valve operator shall have AWWA stops, be suitable for submersible service and be sized in accordance with AWWA torque requirements for a full 150B rated valve.

The manufacturer of the butterfly valve shall be fully responsible for the satisfactory performance of the assembled valve and operator unit. The specified operators shall be factory mounted by the valve manufacturer and shipped to the job site as an operating unit. External painting, hydrostatic testing, travel stop adjustments and crating for shipment shall be in complete compliance with the latest AWWA specification for butterfly valves.

All butterfly valves shall be installed in a standard eccentric precast manhole (diameter appropriate with size valve). Standard Detail W-16

f. Fire Hydrants

Fire hydrants shall comply with AWWA C-502-94 as manufactured for the City of Raleigh by Kennedy, Mueller, Clow, American Darling, M & H, AVK, East Jordan Iron Works, US Pipe, or Waterous.

Nozzles shall have Raleigh Standard Threads and shall consist of the following: 2-two-and one-half inch nozzles, and 1- 5" Storz connection nozzle. The nozzle shall be an integral part of the fire hydrant and must be

furnished by the manufacturer or authorized distributor designated by the manufacturer. Storz connector shall have the following characteristics: brass hydrant nozzle connection; have hard anodized aluminum Storz ramps and lugs (hydrant and cap side); and require a high-torque Storz spanner wrench in order for the cap to be removed. See Details W-5 & W-6. All nozzles shall be provided with cap and cap retaining chain. The hydrant valve opening shall be five and one-quarter inches with no exceptions. Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seating attaching assembly. All hydrants must include cast or ductile epoxy lined shoe, rubber drain seals and positive, protective valve stop device.

Hydrants shall be open-left type and shall have a six-inch hub-end or mechanical joint elbow. The hydrant barrel shall be of sufficient length to provide a minimum of three and one-half feet of bury and be of the break-away impact type.

g. Air Release Valves

Air release valves shall be two-inch Crispin Pressure Air Valves, Model P 20, with a vacuum check unit, or two-inch Val-Matic, Model VM-45, with a vacuum check unit or equal as approved by the Public Utilities Director. These valves shall be suitable for 150 psi working pressure and designed to allow air to escape automatically while the main is in service and under pressure. The valve shall be housed in a City of Raleigh approved eccentric manhole and shall be installed in accordance with Detail W-19 of these specifications. Air release valve locations shall be approved by the Public Utilities Department, or as shown on the plans. The engineer must field stake the air release location.

h. Tapping Sleeves and Tapping Saddles

Tapping sleeves shall be Mueller mechanical joint, Mueller Outlet Seal, American Uniseal, Kennedy Square Seal, or Clow F5205 or F5207. 100% stainless steel sleeves may also be used, as manufactured by Rockwell, Romac, Ford, or JCM provided that all metallic parts of the sleeves shall be 100% stainless steel including bolts. Ductile iron flanges may be included on sleeves or saddles. All sleeves shall have a minimum of 150 psi working pressure. All taps shall be machine drilled--no burned taps will be allowed.

Tapping saddles may be used on mains 16-inches and larger. In 16 and 24 inch saddles as manufactured by Mueller, American, Kennedy and Clow tapping saddles shall be manufactured of ductile iron providing a factor of safety of 2.5 at a working pressure of 250 psi. In main sizes of 30-inch and larger, ductile iron tapping saddles as manufactured by American Pipe Company or US Pipe Company shall be utilized.

Saddles shall be equipped with a standard AWWA C-110-98 flange connection. Sealing gaskets shall be "O" ring type, high quality molded

rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Saddles may be used for taps one-half the size of the main or less (i.e. 8-inch tapping saddle for use on a 16-inch main).

i. Water Service Connections

Water service pipe for 3/4 - to 2-inch connections shall be type "K" soft copper with no joints or couplings in the right-of-way. On these water services, the fittings shall be flared copper type brass fittings or compression type fittings.

1 1/2 inch and 2 inch taps may only be made with use of a double strap bronze saddle.

Corporation cocks for direct 3/4" and 1" taps may be used on ductile iron pipe and shall have AWWA Standard tapered threads. Unions shall be three piece copper to copper.

Curb stops used on gang meter assemblies shall be as manufactured by Mueller, Oniseal, Hayes NuSeal, Ford, A.Y. McDonald ball valve. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material corporation and curb stops as manufactured by Mueller, Ford, and A.Y. McDonald and must have a complete ball and installed in a valve box.

Curb stops are required for 1 1/2" and 2" meters and shall be located 2' from the meter box on the street side. Curb stops shall be installed in an approved valve box.

Water meter gang assemblies of 3/4 and 1 inch meters may be allowed on 3/4-inch to 2-inch service connections and shall conform to the requirements shown in Detail W-26.

Service saddles shall be all bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The clamp shall have corporation cock threads. These clamps shall be as Mueller H-16100 series, Jones J 979 or approved equal.

For services greater than 2 inches, the water service pipe shall be 4, 6, 8 or 12 inches in diameter and shall be of ductile iron pipe. Cast iron or ductile iron fittings shall be used on these services. All taps will be made by using the appropriate size tapping sleeve and valve. See Detail W-14. On a "dry line", the connection may be made with a "TEE and Valve" as shown in Detail W-15.

Coppersetters or copper meter yokes shall be 5/8 inch and 12 inches in height as manufactured by Ford or approved equal. All coppersetters shall have locking wings on the angle valve and be of the Ford angle check type.

Curb stops on gang meter assemblies shall be as manufactured by Mueller, Oniseal, Hayes Nuseal, Ford, and A.Y. McDonald. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material as manufactured by Mueller, Ford, and A.Y. McDonald.

j. Meters

All water meters shall be provided and installed by the City of Raleigh Public Utilities Department Meters Division.

k. Meter Boxes and Vaults

All meter boxes shall be constructed of cast iron, precast concrete, concrete block, high-density polyethylene, or cast-in-place concrete as on details W-23 thru W-35.

Meter boxes shall not be placed within the sidewalk unless no other alternatives are available and approval is obtained by the Public Utilities Director.

l. Water Backflow/ Cross Connection

The backflow assemblies/devices are made of approved brass, stainless steel, or fusion bond epoxy coated ductile iron. A list of the approved devices at the time of the printing of this Handbook is included at the end of the Water Materials section. This list is updated on a regular basis.

m. Steel Encasement Pipe

Steel pipe for boring installations shall be high strength steel, welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum casing pipe wall thickness shall be 0.375" for bored encasement.

The outside of the pipe shall be coated with 2 coats of a compatible black epoxy with a total dry film thickness of 8 – 10 mils per coat. Epoxy coating shall be Tnemec Hi-Build Tneme-Tar Series 46H-413, or approved equal.

Pipe ends shall be right-angled and shall be compatible to receive a "Dresser style 62" - Type I or approved equal mechanical transition coupler.

The pipe shall be coated inside and outside, in accordance with AWWA C203-97, ASTM standards and any additional requirements of the N.C. Department of Transportation or the American Railway Engineering Associations' specifications if applicable. All encasement pipe must be

approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be slip joint ductile iron and the minimum inside diameter casing shall be eight inches greater than the inside dimension of the carrier pipe as follows:

<u>Carrier Pipe Nominal Diameter</u>	<u>Steel Casing Pipe Minimum Inside Diameter</u>
4 inch (private only)	12 inch
6 inch	14 inch
8 inch	16 inch
12 inch	20 inch
16 inch	24 inch

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two "spiders" per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Detail W-40.

n. Irrigation Rain Sensors

Irrigation rain sensors are devices mounted in an open outdoor area at least five feet from any structure and wired to the common wire of all permanent in ground irrigation systems. Rain sensors shall be capable of overriding the irrigation controller when 1/4" of rainfall has occurred to keep the system from watering in the rain. Rain sensors shall also be UL listed and installed per the manufacturers recommendations.

o. Irrigation Programmable Controllers

Irrigation programmable controllers are devices installed on all permanent in ground irrigation systems that operate the watering cycle of an irrigation system. Controllers shall be programmable by day of the week and UL listed.

CITY OF RALEIGH
BACKFLOW PREVENTER APPROVAL LIST
 (REVISED 3/31/05)

<u>TYPE OF PROTECTION</u>	<u>DEVICE/ASSEMBLY –MFG.</u>	<u>BFP SIZE</u>
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RESIDENTIAL:

Dual Check Valves/Resetters

FEBCO 810
 WILKINS #700 & #705
 WILKINS 950LM & 950LF
 WATTS #7
 CONBRACO 40-300 & 4P-300

&
METER WITH WITH
DUAL CHECK

FORD ANGLE CHECK

3/4" - 1"

FORD HHC

RESETTERS & RETROSETTERS

A. Y. McDONALD 4135(11-3)series
 A. Y. McDONALD 4135(12-3) series
 10 MSR A.Y. McDONALD
 FORD STYLE C
 WATTS WES2-7

NEPTUNE TECHNOLOGIES DUAL CHECK + T-10 METER

NON-RESIDENTIAL:

Continuous Pressure Backflow Preventer

CONBRACO 40-400
 WATTS 9DM2 & M3
 FEBCO 815

1/2" & 3/4"

Low Hazard

WILKINS 750

Carbonated Beverage Machine &

WATTS SD-2-MF &
 WATTS SD-3-MF

1/4" & 3/8"

Ice Machine

Low to High Hazard

CONBRACO 4C-101-1 &
 CONBRACO 4C-102-1

1/4" & 3/8"

Laboratory Faucet Vacuum Breaker
All High Hazard

CONBRACO 38-500
 WATTS NLF9
 WATTS N9

1/4" & 3/4"
 3/8" Only
 1/4" & 3/4"

<u>TYPE OF PROTECTION</u>	<u>DEVICE/ASSEMBLY-MFG.</u>	<u>BFP SIZE</u>
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Hose Bibb Vacuum Breaker

CONBRACO 38-304, 404 &
 38P & 38-304-02

Low to High Hazard

WATTS 8, S8C, 8A, 8P, NF8
 WATTS FROST PROOF FAUCETS-
 (Residential & WILKINS BFP-8 & BFP-8F
 Commercial) ALL WOODFORD MODELS W/BFP

3/4" HOSE
 3/4" HOSE
 3/4" HOSE

AMES A100

3/4"-2"

DOUBLE CHECK VALVE ASSEMBLIES

<u>TYPE OF PROTECTION</u>	<u>ASSEMBLY-MFG.</u>	<u>BFP SIZE</u>
Nonresidential & Domestic	AMES 2000B & M3(3/4" Only)	1/2"-2"
	AMES 2000CIV	4"-10"
	AMES 2000SE	2 1/2" & 6-8"
	AMES 2000SSM	4" & 6"
	AMES 2000SS	2 1/2"-8"
<u>Double Check Valve Assemblies</u>	AMES 200	2 1/2"-6"
<u>Low Hazard</u>	AMES COLT 200a & Na	2 1/2"-6"
	AMES MAXIM 200a & Na	2 1/2"-4"
CONBRACO 40-103-109(02)Standard & Top Entry		1/2"-2 1/2"
This Includes T2 & TC2		
CONBRACO 40-100-10G(02-06)		3"-10"
CONBRACO 1/2DC & 2 1/2-10 DC		1/2" & 2 1/2"-10"
FEBCO 805Y		3/4"-2"
FEBCO 805YD		2 1/2"-10"
FEBCO 850U & 850F (3/4" Only)		1/2"-2"
FEBCO 850		1/2"-8"
FEBCO 870		2 1/2"-10"
(N & Z Configurations) FEBCO 870V		2 1/2"-10"
FLOMATIC DCV		3/4"-6"
FLOMATIC DCVE		3/4"-2"
WATTS 007		2 1/2"-3"
WATTS 007M3QT (All Variations Including U Models)		3/4"-2"
WATTS 709		2 1/2"-10"
WATTS 757		2 1/2"-4"
WATTS 767		2 1/2"-3"
WATTS 774		2 1/2"-10"
WATTS 775QT		1/2"-1 1/2"
WILKINS 350 & 350 A & G		2 1/2" & 10"
WILKINS 450 & 450G		2 1/2" & 8"
WILKINS 950 & 950 A & G		3/4"-10"
WILKINS 950XL;XLT; XLU		3/4"-2"

REDUCED PRESSURE PRINCIPLE ASSEMBLIES

<u>TYPE OF PROTECTION</u>	<u>ASSEMBLY</u>	<u>BFP SIZE</u>
<u>Reduced Pressure</u> <u>Principle Zone Assembly</u>	AMES 4000B, 4000BM3	1/2"-2"
	AMES 4000CIV	2 1/2"-10"
	AMES 4000SS	2 1/2"-6"
	AMES COLT 400	2 1/2"-6"
	AMES MAXIM 400	2 1/2"-4"
<u>High Hazard(RP)</u>		
(N & Z		
Configurations)	CONBRACO 40-200-02, 03 & 05	3"
	CONBRACO 40-201-208(including 99T Models)	1/4"-2"
	CONBRACO 40-204 A2U- 40-208 A2U	3/4"-2"
	CONBRACO 40-209-20G (02,03)	2 1/2"-10"
"		
-		
	FEBCO 825 Y & YA	3/4"-2"
	FEBCO 825 YD	2 1/2"-10"
	FEBCO 860	1/2"-8"
	FEBCO 860U	1/2"-2"
	FEBCO 880	2 1/2" - 10"
(N & Z Configurations)	FEBCO 880V	2 1/2"-10"
	FLOMATIC RPZ	3/4"-8"
	FLOMATIC RPZ II	1/2"-3/4"
	WATTS 009M3QT(Including U Models)	3/4"-2"
	WATTS 009	2 1/2"-6"
WATTS 909M1QT (Including U Models)		3/4"-2"
	WATTS 909M1	1 1/4"-10"
	WATTS 957	2 1/2"-4"
	WATTS 967	2 1/2"-3"
	WATTS 994	2 1/2"-6"
	WATTS 995	1/2"-1 1/2"
	WILKINS 375 & 375A & G	2 1/2"-8"
	WILKINS 475 V & G	2 1/2"& 8"
	WILKINS 975	3/4"-10"
WILKINS 975XL(ALL VARIATIONS)		1/4"-2"

LOW HAZARD
FIRE SPRINKLER SYSTEMS BACKFLOW PREVENTERS

<u>TYPE OF PROTECTION</u>	<u>ASSEMBLY</u>	<u>BFP SIZE</u>
FIRE LINES (SPRINKLER SYSTEMS) <u>Double Check</u> <u>Valve Assembly</u> (DCVA)	AMES 2000B*	1½"-2"
	AMES 3000SE	2 ½" & 6-8"
	AMES 3000SS	2 ½"-10"
	AMES 3000CIV	4"-10"
	AMES 3000B	2"
	AMES COLT 300a	2 ½"-6"
	AMES MAXIM 300a	2 ½"-4"
<u>Low Hazard</u> & <u>Double Detector</u> <u>Check Valve Assembly</u> (DDCVA)	CONBRACO 40-107-108*	1 ½"-2"
	CONBRACO 40-600-60G(03)	3"-10"
	CONBRACO 2 ½-10DCDA	2 ½"-10"
(N & Z Configurations)--	FEBCO 805Y *	1 ½"-2"
	FEBCO 806YD	3"-10"
	FEBCO 850*	½"-2"
	FEBCO 856	2 ½"-8"
	FEBCO 876	2 ½"-10"
	FEBCO 876V	2 ½"-10
	WATTS 007M3QT*	1 ½" & 2"
	WATTS 007DCDA	2"-6"
	WATTS 709DCDA	3"-10"
	WATTS 757DCDA	2 ½"-6"
	WATTS 767DCDA	2 ½"-4"
	WATTS 774	2 ½"-10"
	WATTS 775QT	½"-2"
	WILKINS 350DA	2 ½"-10"
	WILKINS 350DAG	4"-8"
	WILKINS 450DA & 450DAG(4" & 6")	4"-10"
	WILKINS 950XL*	1 ½", 2"
	WILKINS 950DA & 950DAG(4" & 6")	2 ½"-10"
<u>{*13D & 13R Fire sprinkler Systems}</u>		

HIGH HAZARD
FIRE SPRINKLER SYSTEMS BACKFLOW ASEMBLIES

<u>TYPE OF PROTECTION</u>	<u>ASSEMBLY</u>	<u>BFP SIZE</u>
FIRE LINES	AMES 4000B**	1 ½"-2"
(SPRINKLER SYSTEMS)	AMES 5000	4"-10"
	AMES 5000CIV	2 ½"-10"

High Hazard

CONBRACO 40-207-208**	1 ½" & 2"
CONBRACO 40-700-70G(C3) N	3"-10"

Reduced Pressure Principle

Zone Detector Assembly

(RPDA)	FEBCO 825Y**	1 ½"-2"
&	FEBCO 826YD	2 ½"-10"

Reduced Pressure Principle

Zone Assembly

	WATTS 009M3QT**	1 ½"& 2"
	WATTS 909 RPDA	2 ½"-10"
(RP)		

WILKINS 375DA;375DAG;375DAP	2 ½"-8"
WILKINS 475DA	4"-8"
WILKINS 975XL	1 ½"-2"
WILKINS 975DA & DAG	2 ½"-10"

{Note:For 13R & 13D Systems and for isolation of Freeze Protected Sections of Regular Fire Sprinkler Systems}**

APPROVED DOUBLE CHECK VALVE ASSEMBLIES & DOUBLE DETECTOR CHECK VALVE ASSEMBLIES FOR {Vertical Installation} {INLET ON THE BOTTOM UNLESS OTHERWISE SPECIFIED}

<u>TYPE OF PROTECTION</u>	<u>ASSEMBLY</u>	<u>BFP SIZE</u>
	AMES 2000B	1/2"-2"
	AMES 2000CIV	4"-10"
<u>Low Hazard Domestic</u>	AMES 2000SS & SE	2 1/2"-8"
<u>DCVA</u>	AMES COLT 200a {Vertical Up & Down}	2 1/2"-4"
	AMES MAXIM 200a {Vertical Up & Down}	2 1/2"-3"
	CONBRACO 1/2DC & 2 1/2- 6DC	2 1/2"-6"
	CONBRACO 2 1/2 DC-10DC{ Vertical Up & Down }	2 1/2"-8"
	FEBCO 805YB	3/4"
	FEBCO 850{ Vertical Up & Down }	1/2"-2"
	FEBCO 850	2 1/2"-8"
	WATTS 007	2 1/2" & 3"
	WATTS 007QTM3 1/2"-2"	
	WATTS 709	4"-10"
	WATTS 775{ Vertical Up & Down }	1/2"-1 1/2"
	WILIKNS 350 & 350A & G	2 1/2" & 8"
	WILKINS 950XL	3/4"
	WILKINS 950	4"-8"

LOW HAZARD FIRE LINES DDCVA

	AMES 3000B	2"
	AMES 3000 SS, SE & CIV	4"-10"
	AMES COLT 300a	2 1/2"-6"
	AMES MAXIM 300a	2 1/2"-4"
	CONBRACO 2 1/2DCDA-8DCDA	2 1/2"-8"
	FEBCO 856	4"-8"
	WATTS 007DCDA	2" & 2 1/2"
	WATTS 709DCDA	3"-10"
	WATTS 757 & 767(2 1/2"-4")	2 1/2"-6"
	WILKINS 350DA & 350DAG	4"- 10"
	WILIKNS 950DA	2 1/2"-8"

Effective Date: 3/31/05

Note: All large body assemblies (2 ½"-10") shall be fusion bonded epoxy coated ductile iron or be stainless steel. All shut off valves on large assemblies shall be fusion bonded epoxy coated and have a resilient wedge "gate". All shut off valves on small assemblies (1/4"-2") shall be a resilient seat full port quarter turn ball valve with a blow-out proof stem with a pressure rating of 400psi W.O.G. Fire line assemblies shall have OS&Y shut off valves.



CITY OF RALEIGH
Insulated Above Ground Enclosures Approval List

Manufacturer

Model Numbers

Fiberglass Models

HB .75 through HB 10FE

EZ.75; EZ 1 & EZ 2 Hot Box

HB 4N through HB 10E

HB 3000 through HB5000

Aluminum Models

Pressure Vacuum Breaker Models

HPVB-1 through HPVB-2

Hot Rok Models

GHR .75 through GHR 4FE

Poly Rok Model

PHR-1

Aluminum Models

**Safe-T-Cover
By Hydrocowl**

100S Series through 1000DS Series

Fiberglass Models

130D-FG through 835D-FG

MUST BE ASSE 1060 APPROVED

Water Safe

All Aluminum Models
WS-1S through WS-2NSNY-FM
WS-2 through WS-10-OSY-S
WS-4NRS through WS-10 FM-OSY

Fiberglass Only

BF Products, Inc. Model# 270PD, 370PD, 640APD, 800APD, 950APD, 1150APD

Effective Date March 1,2005

SEWER MATERIAL STANDARDS

I. GENERAL MATERIAL

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), the American National Standards Institute (ANSI), the American Association of State Highway and Transportation Officials (AASHTO), and Ductile Iron Pipe Research Association (DIPRA) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. PIPE MATERIALS (Mains Only)

a. Reinforced Concrete Pipe

Reinforced concrete pipe shall be designed and manufactured to the strength requirements of ASTM C-76-99, according to the depth of cut as specified and as shown on the construction drawings. Reinforced concrete pipe may be used for sewer mains 15-inch in diameter and larger. Pipe joints and joint material shall conform to the requirements defined in ASTM C-443-98. All reinforced concrete pipe shall be internally coated with one coat of a 20% solids, deeply penetrating, dual-component polyurea primer (0.5 – 1.0 mils dry film thickness, 150 ft²/gal), one intermediate coat of a dual component polyurea (50-100 mils dry film thickness, 50 ft²/gal), and one top coat of a 65% solids, two-part polyurea (7.5-10 mils dry film thickness, 125 ft²/gal). Polyurea coatings shall be Duramer 1030 as manufactured by SewerKote, or approved equal.

b. Ductile Iron Pipe and Fittings

Ductile iron pipe and fittings used for sanitary sewers shall be manufactured in accordance with AWWA Standards C-150 and C-110 respectively. The minimum pressure class pipe shall be class 250 or a greater class may be required based upon the depth of cover and laying conditions. Pipe shall be supplied in 18 or 20 foot nominal lengths. Pipe and fittings shall have a minimum working pressure of 250 psi, and a minimum iron strength of 30,000 psi. Ductile iron may be used for any sewer main 8-inch and larger.

Pipe joints shall be the "Push-on" type manufactured in accordance with AWWA Standard C-111-95.

Interior Linings for Force Mains, Sewer Mains, Interceptors, and Sewer Service Pipe

All force mains, gravity interceptors, and fittings shall be lined with an amine cured novalac ceramic epoxy containing at least 20% by volume of ceramic quartz pigment. The lining material shall have a permeability rating of zero when tested in accordance with Method A – ASTM E96-66, Procedure A with test duration of 30 days. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. Within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal DFT. No lining shall take place when the substrate or ambient temperature is below 40° F. The surface shall also be dry and dust free. The lining shall not be used on the faces of the flanges (if applicable).

Due to the tolerances involved, the gasket area and spigot end up to 6-inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum of PROTECTO Joint Compound or approved equal. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

The number of coats of lining material applied and the touch up and repair of the lining shall be as recommended by the manufacturer. The pipe manufacturer shall provide a certification attesting that the application meets or exceeds the requirements of these specifications.

Lining material shall be PROTECTO 401, or approved equal.

c. PVC Gravity Sanitary Sewer Pipe

PVC gravity sanitary sewer pipe and related fittings shall be manufactured in accordance with all the requirements of ASTM D-3034-98 SDR 35 Type PSM polyvinyl chloride sewer pipe and fitting. PVC gravity sewer pipe may be used for 8, 10, 12 or 15 inch mains and shall be supplied in 12.5 foot lengths with bell-and-spigot joints. ASTM F679-95 shall establish the requirements for 18, 21, 24 and 27-inch diameter PVC, SDR 35 gravity sewer pipe. The length of joints shall be at least 11 feet for the larger PVC pipe, unless approved differently by the Public Utilities Director. All fittings shall use rubber gaskets, which conform to the requirements of ASTM F477-99.

d. Steel Pipe

Steel pipe for aerial creek crossings shall be high strength steel, helical or straight seam welded manufactured in accordance with ASTM A 139 and consisting of grade "B" steel with a minimum yield strength of 35,000 psi. Boring installations shall be high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum casing pipe wall thickness shall be 0.375" for bored encasement and in accordance with the table provided in sewer detail S-12 for aerial encasement. Thicker encasement pipe may be required by the North Carolina Department of Transportation, railroads, or other agencies.

The outside of the pipe shall be coated with 2 coats of a compatible black epoxy with a total dry film thickness of 8 – 10 mils per coat. Epoxy coating shall be Tnemec Hi-Build Tneme-Tar Series 46H-413, or approved equal.

Pipe ends shall be right-angled and shall be compatible to receive a "dresser style 62" - Type I or approved equal mechanical transition coupler.

The pipe shall be coated inside and outside, in accordance with AWWA C203-97, ASTM standards and any additional requirements of the N.C. Department of Transportation or the American Railway Engineering Associations' specifications. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

If the encasement pipe is used to carry a sewer main larger than 8-inch in diameter, then a vent pipe shall be installed. The vent pipe shall be made from ASTM A139, grade "B" steel, with a minimum yield strength of 35,000 psi and coated as described above or factory galvanized. The vent pipe location shall be approved by the appropriate agency prior to installation. See Detail S-18.

All carrier piping shall be slip joint ductile iron and the minimum inside diameter casing shall be eight inches greater than the inside dimension of the carrier pipe as follows:

<u>Carrier Pipe Inside Diameter</u>	<u>Steel Casing Pipe Minimum Inside Diameter</u>
4 inch	12 inch
6 inch	14 inch
8 inch	16 inch
12 inch	20 inch
16 inch	24 inch

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two spiders per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Detail S-39.

f. Prestressed Concrete Sewer Pipe

Prestressed concrete sewer pipe shall meet all the material specifications applicable under AWWA C-301-84 and ASTM C76-99 and shall meet or exceed the load requirements of ASTM C76-99. The pipe shall have a minimum laying length of 16 feet and shall be eligible for use in diameters 48 inch and greater. All prestressed concrete pipe shall be lined. Lining requirements are the same as listed for reinforced concrete pipe.

3. MANHOLES AND RELATED MATERIALS

Manholes will be precast reinforced concrete. Eccentric or concentric cones may be used on 8 through 12-inch mains. Concentric cones will be used on all 15 inch and larger mains. These different type manholes shall conform to these specifications and the City of Raleigh Standard Details. All manholes located outside public right-of-way must be one foot above the 100-year flood or be sealed as per Details S-24 & S-27. Sealed manholes must be vented every 1000 feet as per Details S – 24 & S-27. "Candy cane" vent stacks on sewer manholes must be "factory" fabricated and "hot dipped" galvanized, NOT field fabricated and galvanized. All manholes shall be watertight. All manhole covers installed within streets, parking lots, and other paved areas shall have only one 1-inch hole, which shall be off center and fitted with a rubber grommet, unless seal-down manholes are required. Manhole

Interior Linings for Precast Reinforced Concrete Manholes

All sanitary sewer interceptor/outfall manholes and manholes receiving a sanitary sewer force main discharge shall be internally coated with one coat of a 20% solids, deeply penetrating, dual-component polyurea primer (0.5 – 1.0 mils dry film thickness, 150 ft²/gal), one intermediate coat of a dual component polyurea (50-100 mils dry film thickness, 50 ft²/gal) and one top coat of a 65% solids, two-part polyurea (7.5-10 mils dry film thickness, 125 ft²/gal). All coats can be applied by brush, spray, or roller. Polyurea coatings shall be Duramer 1030 as manufactured by SewerKote, or approved equal.

a. Precast Reinforced Concrete Manholes

The concentric and eccentric manholes shall be designed and manufactured in accordance with ASTM C478-97. Manhole diameters shall be 4, 5, or 6 feet in diameter as determined by the table within Sewer Design standards for main size or depth. The walls shall be a minimum of 5 inches thick and have a 6-inch minimum base. The standard joint shall be sealed with cementitious grout meeting all Federal Specifications. An O-ring or "ram neck" joint seal may be used. All exterior joints shall be wrapped with a butyl resin sealant of 8" width. The "O" ring joint shall conform to the requirements of ASTM C443-98. A flexible rubber boot shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C923. See Detail S-24 – S-27.

The manufacturer shall submit drawings showing the reinforcing, pipe openings and other details for approval by the Public Utilities Director. Also, the manufacturer shall provide certified test reports indicating that the materials comply with the requirements of ASTM C478-97. "Extended base" precast sections must comply with Detail S-21 dimensions and equivalent reinforcing.

b. Related Materials

- 1) Manhole rings and covers shall be manufactured to the dimensions shown on the Details S-25 - S-27 and shall be made from Class 30 gray iron, meeting the requirements of ASTM A48-94ae1. All covers must be domestically cast and so indicated by manufacturer name and "USA" in castings. Covers shall have "DANGER PERMIT REQUIRED – CONFINED SPACE DO NOT ENTER" cast onto the face as shown in Detail S-25. All manhole rings on flat-top manholes shall be cast into the manhole top, as shall be the flange for the vent stack, if applicable. See Details S-24. Cam Lock covers shall be used on all manholes that are within easements. See details 24 & 27.
- 2) Manhole steps shall be made from reinforcing steel which is rubber plastic coated to provide for safer footing. These steps shall be furnished in accordance with the Detail S-28 and the applicable OSHA regulations. Steps shall also be provided on outside of raised manholes when top elevation is greater than three (3) feet above existing ground elevation. All traffic bearing castings must be Class 35 or greater.
- 3) Cement used in masonry or reinforced concrete units shall be Type I, CSA normal, meeting ASTM C150-99, unless otherwise approved by the Public Utilities Director.
- 4) Concrete shall be only plant-mixed or transit-mixed concrete conforming to ASTM C33-99ae1 as to aggregates and to ASTM C94/C94M-99e1 for ready-mixed concrete.

Concrete shall be of three types as based on 28-day compressive strength:

Type AA	4500 psi
Type A	3000 psi
Type B	2500 psi

Concrete shall be air-entrained, unless specified otherwise, with 4 to 6% air. Retarders and accelerators shall be used only as directed by the engineer.

Concrete used for structures such as sewage lift stations and other reinforced concrete structures shall meet all applicable provisions of the NCDOT specifications regarding manufacture, delivery and placement.

- 5) Steel reinforcing for concrete structures shall meet all applicable provisions of the NCDOT specifications as to manufacture, fabrication and placement.
- 6) Mortar used for sewer structures shall conform to ASTM specification C144-99 as to aggregate and strength. Mortar shall be prepared from cement in perfect condition and shall be prepared in boxes for that purpose. No mortar that has stood beyond forty-five minutes shall be used. Proportion by volume for different kinds of work shall be:

Brick Masonry	1 part cement to 2 parts sand
Pointing	1 part cement to 1 part sand

- 7) Rubber boot sleeves shall meet or exceed ASTM C923 for connecting pipes to thru the barrel section of the manhole. Boot sleeves shall have stainless steel expansion bands and pipe clamps that meet or exceed ASTM C923 and A167.
- 8) Manhole inverts shall be constructed with a width equal to that of the effluent pipe, height to the springline and invert "shelves" from that point upward at a 60 deg. angle to the manhole walls. The invert shall be brushed and troweled that a minimum energy loss occurs in the manhole from invert roughness. "Bowl" shaped invert will not be allowed.

4. MISCELLANEOUS MATERIALS

a. PVC Sewer Service Pipe

PVC sewer service pipe shall be schedule 40 PVC including the clean-out stack provided that a bronze clean-out slotted plug for location purposes.

b. PVC Sewer Pipe and Saddles

PVC sewer pipe, saddles and adapters shall conform to the requirements of ASTM D3034-98. The saddle shall be installed in accordance with Standard Details S-31 and S-32.

c. Sewer Force Main Material

Sewer force mains shall be ductile iron sewer pressure pipe.

d. Sewer Air Release/Vacuum Breaker Valve Material

Air release/vacuum breaker valves on sewer force mains shall be in accordance with Detail S-9.

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REUSE MATERIAL STANDARDS

1. GENERAL MATERIAL REQUIREMENTS

Current specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications. All material used shall conform fully to these current standards or be removed from the job at the direction of the Public Utilities Director.

Pipe specimens shall be subjected to tests by an independent testing laboratory at such time as the Public Utilities Department may direct or as specified herein. Pipe not meeting these specifications will be ordered removed by the inspector, and such pipe shall be immediately removed from the job site and not transported to any portion of the project being constructed.

Detail or shop drawings of valves, air release valves, tapping sleeves and tapping saddles must be approved by the Public Utilities Department prior to installation.

These specifications are not to be considered as proprietary in any way. When a particular brand is listed, it is only used as an aid in describing the type of material being requested.

2. REUSE SYSTEM MATERIALS

A. Reuse Mains

All 4 through 24 inch reuse mains shall be either buried polyvinyl chloride (PVC) pressure pipe or ductile iron pipe (DIP) as specified herein.

Polyvinyl Chloride (PVC) Pressure Pipe

PVC pressure reuse mains shall conform to the applicable requirements of ANSI/AWWA C900 for 4-inch through 12-inch pipe and ANSI/AWWA C905 for 14-inch through 24-inch diameter pipe. PVC pipe and fittings shall be provided with cast-iron-pipe-equivalent outside diameters. Wall thickness dimension ratios for 12-inch and smaller pipe shall be DR 14 or DR 18, in accordance with the applicable requirements of ANSI/AWWA C900. Wall thickness dimension ratios for 14-inch and larger pipe shall be DR 18 or DR 25, in accordance with the applicable requirements of ANSI/AWWA C905. PVC pipe shall be designed in accordance with AWWA M23, PVC Pipe – Design and Installation, 1980.

PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Polyethylene encasement shall be tube or sheet type and conform to ANSI/AWWA C105/A21.5. Joint tape shall be self-sticking, PVC or polyethylene, 10 mils thick; such as Chase "Chasekote 750", Kendall "Polyken 900", or 3M "Scotchrap 50".

All PVC pipe shall be provided with tracer tape to allow for location of the buried pipe. The tracer tape shall be at least 3 inches wide and 0.5 mil thick. The tracer tape shall have an aluminum foil core and be encased in a protective inert plastic jacket. The tracer tape shall have a minimum tensile strength of 5,000 psi and a minimum mass of 2.5 lbs per inch per 1,000 feet. The tracer tape shall be Allen Systems "Detectatape", Lineguard "Type III", or Reef Industries "Terra Tape D". Tracer tape shall be buried above the PVC pipe, not more than 18 inches below the ground surface.

Pipe, fittings, and accessories shall be handled in accordance with Chapter 6 of AWWA Manual M23, to ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.

Ductile Iron Pipe (DIP)

All DIP reuse mains shall be pressure class or thickness class designed in accordance with AWWA Standard C-150. Design shall be done for external and internal pressures separately, using the larger of the two for the next design thickness. An additional allowance shall be made for corrosion and casting tolerances. The thickness design for external and internal pressures shall use the following conditions:

- 1) 3 feet minimum cover or as shown on the plans;
- 2) Laying condition - Type 1;
- 3) A minimum working pressure of 150 psi for pipes 16 inches and smaller in diameter, and for 24 inches and larger pipe, the design working pressure shall be as determined by the Public Utilities Director, and
- 4) A surge pressure of 300 psi.

All calculations for thickness shall be in accordance with the latest AWWA Standard C-150, and the calculations shall be submitted to the Public Utilities Director for approval prior to shipping any pipe. The minimum thickness shall be pressure class 350 for pipes 4 inches through 12 inches and pressure class 250 for pipes 16 inches and larger in diameter.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of the latest AWWA Standard C-151. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with the latest AWWA Standard C-104. Ductile iron pipe shall

be externally bituminous coated in accordance with the latest AWWA Standard C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with the latest AWWA Standard C-111-95

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacture to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with the latest AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, McWane Cast Iron Pipe Company, or approved equal.

Restrained joints shall be TR Flex or Lok Tyte as manufactured by U.S. Pipe, Lok-Fast or Lok-Ring as manufactured by American Pipe, Super-Lock as manufactured by Clow, Bolt-lok or Rigid-lok as manufactured by Griffin or approved equal.

B. Fittings

Polyvinyl Chloride (PVC) Pressure Pipe Fittings

All fittings to be used with PVC pipe shall be cast iron and conform to the applicable requirements of ANSI/AWWA C110/A21.10 with a 250 psi pressure rating, except shorter laying lengths will be acceptable.

PVC to PVC joints shall be stab type, with elastomeric synthetic rubber gaskets, and conform to ANSI/AWWA C900. PVC to cast iron joints shall conform to ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber gaskets will not be acceptable. All surfaces for gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. Each spigot shall be suitably beveled to facilitate assembly.

Ductile Iron Pipe (DIP) Fittings

All ductile iron pipe fittings shall be manufactured in accordance with AWWA Standard C-110-98 or C-153-88 for ductile iron compact fittings.

The fittings shall be tested and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be all-bell or mechanical joint. Mechanical joints shall be manufactured in accordance with the latest AWWA Standard C-111.

All fittings shall be cast iron or ductile iron and shall have a minimum working pressure rating of 250 psi and a minimum iron strength of 30,000 psi.

All fitting interiors shall be cement-mortar lined with a sealcoat in accordance with the latest AWWA Standard C-104-95, and the outside shall be bituminous coated.

Restrained mechanical glands may be used where restraint is needed except when welded restraining rings are required.

C. Gate Valves

Cast iron or ductile iron resilient wedge style vertical or horizontal gate valves and tapping valves shall be used. Gate valves twelve (12) inches in diameter and smaller, shall be mechanical joint or hub-end all-bell. They shall be "O" ring, open-left valves of the non-rising stem type. These valves shall be designed for a minimum of 175 psi working pressure and 300 psi hydrostatic test pressure with a two (2) inch operating nut.

Gate valves, horizontal gate valves, or butterfly valves shall be used for all main line valves in sizes 16 inches through 24 inches.

Gate valves shall be as manufactured by American, Mueller, Kennedy, AVK, Clow, M&H, or Waterous valves, in accordance with the latest AWWA Standard C-509-94, C-515, or the appropriate AWWA standard. All resilient wedge valves shall have internal and external epoxy coating, O-ring seals at the stuffing box and bonnett to body and dual O-rings at the stem seal above the thrust collar.

Tapping valves shall be the same valves as gate valves listed above, subject to the standards, providing that tapping valves shall have the tapping ring.

D. Valve Boxes

Adjustable valve boxes shall be class 35 gray cast iron and manufactured in accordance with ASTM A48 and be of the dimensions specified in Detail W-17 of these specifications. Lids shall have the word "Reuse", "Reuse Water", or "Reclaimed Water" cast into the lid. See Detail W-18. All castings must be domestically cast and so indicated by the manufacturers name and "USA" cast into all sections of the valve box. All castings must meet or

exceed AASHTO H-20 load rating. Total valve box weight shall be a minimum of 85 lbs and have a minimum lid weight of 25 lbs. All valve boxes shall be furnished with an approved operating key which shall allow operation by authorized personnel only

E. Butterfly Valves

Butterfly valves greater than (16) inches in diameter shall be Class 150B and shall conform to the latest AWWA Standard C-504-94, as manufactured by Mueller, Kennedy, Pratt, or American for rubber-sealed butterfly valves and valve operating assemblies. "O" ring seals shall also be used exclusively with worm gear.

All valve end connections shall be mechanical joint or victaulic, as required by the detail drawings. Valve seats shall be stainless steel, bronze mating or resilient material. Resilient seat shall be mechanically attached to the valve disc, or mechanically retained in the valve body. Resilient seat shall be fully field adjustable by mechanical means. The valve disc shaft shall be stainless steel or either stub or thru-shaft design. Shafts shall be provided with two-way disc thrusters that are fully adjustable from the outside. Valve shaft bearings shall be heavy duty bronze, properly fitted into hubs integrally cast in the body of the valves.

All butterfly valve operators shall be worm gear type as manufactured by Philadelphia Gear Works or EPI. The valve operator shall be furnished with a two-inch square operating nut, and be so mounted that the valve will open-left (counter-clockwise). The butterfly valve operator shall have AWWA stops, be suitable for submersible service and be sized in accordance with AWWA torque requirements for a full 150B rated valve.

The manufacturer of the butterfly valve shall be fully responsible for the satisfactory performance of the assembled valve and operator unit. The specified operators shall be factory mounted by the valve manufacturer and shipped to the job site as an operating unit. External painting, hydrostatic testing, travel stop adjustments and crating for shipment shall be in complete compliance with the latest AWWA specification for butterfly valves.

All butterfly valves shall be installed in a standard eccentric precast manhole (diameter appropriate with size valve). See Standard Water Detail W-16.

F. Air Release Valves

Air release valves shall be two-inch Crispin Pressure Air Valves, Model P 20, with a vacuum check unit, or two-inch Val-Matic, Model VM-45, with a vacuum check unit or equal as approved by the Public Utilities Director. These valves shall be suitable for 150 psi working pressure and designed to allow air to escape automatically while the main is in service and under

pressure. The valve shall be housed in a City of Raleigh approved eccentric manhole and shall be installed in accordance with Standard Water Detail W-19 of these specifications. Air release valve locations shall be approved by the Public Utilities Department, or as shown on the plans. The engineer must field stake the air release location.

G. Tapping Sleeves and Tapping Saddles

Tapping sleeves shall be Mueller mechanical joint, Mueller Outlet Seal, American Uniseal, Kennedy Square Seal, or Clow F5205 or F5207. 100% stainless steel sleeves may also be used, as manufactured by Rockwell, Romac, Ford, or JCM provided that all metallic parts of the sleeves shall be 100% stainless steel including bolts. Ductile iron flanges may be included on sleeves or saddles. All sleeves shall have a minimum of 150 psi working pressure. All taps shall be machine drilled--no burned taps will be allowed.

Tapping saddles may be used on mains 16-inches and larger. In 16 and 24-inch saddles as manufactured by Mueller, American, Kennedy and Clow, tapping saddles shall be manufactured of ductile iron providing a factor of safety of 2.5 at a working pressure of 250 psi. In main sizes of 30-inch and larger, ductile iron tapping saddles as manufactured by American Pipe Company or US Pipe Company shall be utilized.

Saddles shall be equipped with a standard AWWA C-110-98 flange connection. Sealing gaskets shall be "O" ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Saddles may be used for taps one-half the size of the main or less (i.e. 8-inch tapping saddle for use on a 16-inch main).

H. Reuse Service Connections

Reuse service pipe for 3/4 to 2-inch connections shall be type "K" soft copper or PVC with no joints or couplings in the right-of-way. On these reuse services, the fittings shall be flared copper type brass fittings or compression type fittings.

1 1/2" and 2" taps may only be made with use of a double strap bronze saddle.

Corporation cocks for direct taps may be used on ductile iron pipe, shall be bronze-construction, and shall have AWWA Standard tapered threads. Unions shall be three piece copper-to-copper.

Curb stops shall be as manufactured by Mueller, Oniseal, Hayes NuSeal, Ford, A.Y. McDonald ball valve. All corporation stops and curb stops shall be bronze ball valves and shall be appropriate material to material corporation and curb stops as manufactured by Mueller, Ford, and A.Y. McDonald and must have a complete ball and installed in a valve box.

Service saddles shall be all bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The clamp shall have corporation cock threads. These clamps shall be as Mueller H-16100 series, Jones J 979 or approved equal.

For services greater than 2 inches, the reuse service pipe shall be 4, 6, 8 or 12 inches in diameter and shall be of ductile iron pipe or PVC as specified above. Cast iron fittings shall be used on these services as specified above. All taps will be made by using the appropriate size tapping sleeve and valve. See Standard Water Detail W-14. On a "dry line", the connection may be made with a "TEE and Valve" as shown in Standard Water Detail W-15.

Coppersetters or copper meter yokes shall be 5/8 inch and 12 inches in height as manufactured by Ford or approved equal. All coppersetters shall have locking wings on the angle valve and be of the Ford angle check type.

I. Meters

All reuse meters shall be installed by the City of Raleigh Public Utilities Department Meters Division.

J. Meter Boxes and Vaults

For users with potable water service, reuse meter boxes shall be located within 5 feet of the potable water meter boxes.

All meter boxes shall be constructed of cast iron, precast concrete, concrete block, high density polyethylene, or cast-in-place concrete as on Standard Water Details W-23 through W-34. No synthetic polymer or plastic boxes shall be allowed, on either public or private systems connected to the City reuse system.

Meter boxes shall not be placed within the sidewalk unless no other alternatives are available.

All meter box lids shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in Section V.A.1.g of these specifications.

K. Reuse Backflow/ Cross Connection

The backflow assemblies/devices are made of approved brass, stainless steel, or fusion-bond epoxy coated ductile iron. A list of the approved devices at the time of the printing of this Handbook is included at the end of the Water Materials section. This list is updated on a regular basis.

L. Steel Encasement Pipe

Steel pipe for boring installations shall be high strength steel, welded or smooth-wall seamless manufactured in accordance with ASTM A252 and consisting of grade 2 steel with a minimum yield strength of 35,000 psi. The minimum casing pipe wall thickness shall be 0.375" for bored encasement.

The outside of the pipe shall be coated with 2 coats of a compatible black epoxy with a total dry film thickness of 8 – 10 mils per coat. Epoxy coating shall be Tnemec Hi-Build Tneme-Tar Series 46H-413, or approved equal.

Pipe ends shall be right-angled and shall be compatible to receive a "Dresser style 62" - Type I or approved equal mechanical transition coupler.

The pipe shall be coated inside and outside, in accordance with the latest AWWA Standard C203-97, ASTM standards and any additional requirements of the N.C. Department of Transportation or the American Railway Engineering Associations' specifications. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be slip joint ductile iron and the minimum inside diameter casing shall be eight inches greater than the inside dimension of the carrier pipe as follows:

<u>Carrier Pipe Nominal Diameter</u>	<u>Steel Casing Pipe Minimum Inside Diameter</u>
4 inch	12 inch
6 inch	14 inch
8 inch	16 inch
12 inch	20 inch
16 inch	24 inch

Both ends of the casing shall be mortared. Metal "spider" pipe alignment devices shall be installed in all casings with a minimum of two "spiders" per pipe joint one fourth of the pipe joint length in from both the bell and spigot ends. See Standard Water Detail W-40.

M. Ground Hydrants

Hose bibs for private reuse systems shall be non-freeze ground hydrants that are lockable or designed to be operated with the use of a special tool. Ground hydrants shall be Watts HY-500, Woodford Y95, Zurn Z-1360, or approved equal.

WATER CONSTRUCTION STANDARDS (Public and Private Systems)

As part of the requirement to obtain construction approval for water main extensions, the engineer shall affix the appropriate permit sticker(s) to the original drawings. The various stickers are shown at the end of the General Policies/Regulations section of this book.

The requirements contained in this section shall apply to water main installations constructed for the Public Utilities Department or for private developers who may or may not dedicate the water improvements to the City. All necessary construction permits must be obtained before construction may begin in accordance with North Carolina State Law.

Any Contractor performing work within the City of Raleigh or City of Raleigh Merger Areas such as Garner, Wake Forest, or Rolesville, shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, backfilling of water mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at 857-4540 and Public Works at 890-3030 and give the location, project name, individual's name, company name, start date and indicate if it involves water extensions.
- c. Contractor shall contact the Public Works department at 890-3030 by 4:15 PM each day to notify where and what will be done the following day. For any work conducted in Garner, Wake Forest, Rolesville, or outside the City of Raleigh Service Area the contractor shall contact the Public Utilities Department at 857-4540 by 4:15 PM to notify where and what will be done the following day. Any work requiring inspector observation outside of the normal workday, Monday-Friday, 7:30 a.m. to 4:15 p.m. will be charged to the contractor at the current inspector hourly rate.
- d. If a developer, engineer or contractor proceeds with the main installation prior to permit issuance the City may require the work to be reinstalled and the developer, engineer or contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).
- e. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities

Department, reviewed and approved. Therefore, the contractor that proceeds with construction prior to this approval, is at his/her own risk.

8. GENERAL TESTING REQUIREMENTS

The City may perform and shall require the contractor to perform, such destructive and nondestructive testing, as it deems necessary in order to inspect the materials and workmanship. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-core method and/or nuclear testing gauges.

3. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all water materials. The contractor shall replace any material which is damaged or defective.
- b. The loading and unloading of all pipe, valves, hydrants, and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day. In extenuating circumstances when the inspector authorizes pipe to remain on the project from one day to the next, the ends of the pipe must be sealed.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for water mains shall be repaired in a manner approved by the City.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

4. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of water mains.
- b. Detours and all traffic control measures shall be set up and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and the North Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights and other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because others approve the detour.
- c. Construction work zone signs and signing procedures shall conform to the MUTCD and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's and the State's Department of Transportation and Inspections for all work to be performed in the public rights-of-way.

5. PROPERTY PROTECTION

Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction.

6. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for the contractor's adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall be required to furnish safety equipment necessary to inspect the work including, but not limited to ladders, gas detectors/oxygen sensors, blowers, etc.

7. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from NCDOT when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local, state and federal permits required for the utility construction.
- c. The contractor must have an approved set of permitted construction plans on site at all times.

8. PAVEMENT REMOVAL AND REPLACEMENT

- a. All pavements to be removed shall be cut along straight lines with the appropriate saw cut machine. The removal and replacement of the pavement shall conform to the information shown in Details W-1 & W-2.
- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching.
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Note 2 and 3 of detail W-2.
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details W-1 thru W-3, plus six inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

9. VALVE OPERATIONS

- a. No valve in the existing system shall be operated without following the procedure outlined below. Failure to comply with these requirements shall be grounds for suspension of pipe-laying operations until written assurance can be obtained from a company official that such noncompliance will not occur again. The contractor should be aware that the City regards violations of these requirements as justifying punitive measures.
- b. Notification procedures are as follows:
 - 1) The contractor shall notify the Public Utilities Department's Water Distribution Division at 250-2737 in order to request the operation of any valves. At least twenty-four hours notice must be given to the Public

Utilities Department, and at least twenty-four hours notice must be given to each customer affected by a water cut-off. The contractor is responsible for notifying the affected customers. All valve operations shall be done by Public Utilities Department personnel or by the City's inspector for a particular project. It is illegal for anyone other than a City of Raleigh employee to operate an existing water main valve, unless accompanied by a City of Raleigh employee.

2) The contractor shall provide the following information when calling the Water Distribution Division for valve operation:

- (a) Name of person calling;
- (b) Name of company;
- (c) Telephone number of company;
- (d) Location of valve and map number if available;
- (e) Reason for requesting operating and whether to be closed or open;
- (f) Time valve to be opened or closed, and
- (g) Approximate time water line to be out of service.

c. Each time a contractor needs a valve operated, he/she shall again secure permission, following the steps outlined.

d. System valves shall be defined as any valve, which has main pressure against either gate face. Newly installed tapping valves and control valves to networks not yet accepted for service are considered as system valves. Valves within a network still under construction are not considered as system valves.

10. CONSTRUCTION WATER

The City of Raleigh Public Utilities Department does not provide free or otherwise unmetered construction water for any construction project. Hydrant meters may only be moved with the express written permission of the Public Utilities Department. In residential areas hydrant meters may only be used for the filling of swimming pools unless prior approval of the Public Utilities Department. Contractors are responsible for adequate construction water for their job sites in one of the following approved manners:

- a. Apply for permanent water service connection at the Inspections Department Permit Office, 4th floor, Raleigh Municipal Building, 222 West Hargett Street, (890-3450). Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.
- b. Apply in person with the Public Utilities Meters Division Office, 3304 Lake Woodard Drive, for rental of a hydrant meter. There are a limited number of these meters and they are reserved in advance by contacting the Meters Division (250-2797). A deposit is required along with a per month rental fee

per account plus the cost of the water used, at the outside City rate. Hydrant meters are read in 100 cubic feet (ccf). There is a minimum rental fee and an administration fee for billing and closing an account. A service charge is charged when accounts are closed. Customers are responsible for notifying the Meters Division if the meter is not registering usage. The following information is required:

- (1) Meter location;
 - (2) Billing address, telephone number, responsible party name, and federal tax id#
 - (3) Location of hydrant;
 - (4) Water to be used for;
 - (5) Duration of use and frequency of meter reading,
 - (6) Meters must be brought to the Utilities Operations Center for monthly reading.
- c. Upon application approval, the City shall install hydrant meters and approved backflow prevention devices on the fire hydrant requested by the customer, but acceptable to the City, within three (3) business days of the application and deposit being received.
- d. Hydrant meters accounts are billed monthly. Failure to report usage in timely manner for billing or accounts that are not paid in full will result in the loss of water service and the closing of the account with the City.
- e. Hydrant meters will only be set when the temperature is over 35 degrees. Damage to meters from the cold weather or abuse will be charged to the customers.
- f. Hydrant meters used for long term use shall be returned at the end of every one year block for inspection.
- g. Upon completion of hydrant usage, deposits shall be refunded to customers within 30 days provided the following has occurred:
1. Hydrant meter and backflow device have been returned in good condition, with no excessive wear nor damage.
 2. All outstanding water usage charges and rental charges for the meter and backflow device have been paid in full by the customer.
- h. The cut off to apply for new accounts is 3:00 PM each business day.
- i. It is a violation of the City Code to establish a direct connection to a fire hydrant to fill a tank or tank vehicle. It is also illegal to use a RP or Double detector check valve on a domestic or fireline service for temporary water service. Violations of the City Code will result in loss of service, fines, and other measures as specified by the Code.

- j. Continued use of a hydrant meter, when usage readings are not being registered is considered theft of City water and subject to civil penalties of \$500.00/day. It is the responsibility of the customer to notify the Meters Division at 250-2737 when the meter is not registering/recording the water usage properly.
- k. Hydrant meters and backflow assemblies approved for use in this program is the property of the City of Raleigh Public Utilities Department. Failure to return the hydrant meter and backflow preventer at the end of the rental period will be considered theft of City property and prosecuted to the fullest extent of the law.

Note: Individuals caught using water unmetered and/or unauthorized by the Public Utilities Department will be prosecuted to the fullest extent of the law.

11. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division (250-2737).
- b. Trench width shall be a minimum of twelve inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless OSHA requires additional trench width. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Detail W-3.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly compacted to 95% or use #67 stone to bring to grade.
- d. The maximum length of open trench shall be no more than three hundred feet, unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at the his/her own expense, keep all trenches free from water during the excavation for construction of foundations, masonry, water mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the work in progress. Erosion control measures shall be utilized during this pumping.
- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector, or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with

material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.

- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Transportation Director, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- h. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Public Utilities Director or Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.

12. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding $\frac{1}{2}$ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made 6-inches lower than the outer bottom of the pipe, and this 6-inches shall be refilled with 6-inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done under the supervision of the City Inspector or Engineer and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-

hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.

- 1) Date of shot
- 2) Time of shot
- 3) Crew Supervisor
- 4) Number and depth of holes
- 5) Approximate depth of overburden
- 6) Amount and type of explosive used in each hole
- 7) Type of caps used (instant or delay)
- 8) The weather
- 9) Seismograph instrument and readings

- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to hold the City of Raleigh harmless from any claims.

13. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and drained so that workers may work therein safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In discharging trench water, it will be necessary to follow standard erosion control measures so as to minimize erosion and sedimentation. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system.
- b. The width of the trench may vary with the depth of cut and other conditions the trench shall be in accordance with the dimensions set forth by OSHA and other information shown on Detail W-3.
- c. The foundations for ductile iron shall be a firm and stable flat bottom (Type 1) trench with bell holes so that the pipe rests uniformly on the entire barrel length. See Detail W-3.
- d. Pipe clearance in rock shall be a minimum of six inches below and on each side of the pipe for sized sixteen inches and less in diameter. For sizes larger than sixteen inches in diameter, the minimum clearance shall be nine inches below and on each side.

14. PIPE INSTALLATION

- a. Ductile iron pipe shall be installed in accordance with the requirements of AWWA Standard C-600-87.
- b. Water pipe shall be laid to the line and grade shown on the plans with all valves and hydrants located as shown on the plans.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made only on revised plans upon approval by Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.
- f. Depth of pipe cover, unless shown otherwise on the plans shall be three feet above top of pipe. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe.
- f. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job.
- h. Pipe interior shall be swabbed clean with sodium hypochlorite solution before it is laid, and any pipe which cannot be cleaned with a swab shall be removed and cleaned with suitable apparatus. Any pipe showing evidence of oil, tar or grease shall be permanently marked and removed from the job.
- i. Laying of pipe and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed. No chlorine powder or tablets shall be put in the lines during installation.
- j. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.
- k. Pipe cutting for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner in accordance with the manufacturer's recommendations and without damage to the pipe.

- l. Bell ends will face the direction of laying unless otherwise directed by the Public Utilities Director or Engineer. For lines on an appreciable slope, the Public Utilities Director or Engineer may also require that bell ends face upgrade.
- m. Maximum horizontal deflections for ductile iron pipe shall be as follows for an eighteen foot joint of pipe:

MAXIMUM DEFLECTION IN INCHES

<u>Size Pipe</u>	<u>MJ</u>	<u>Push-on-Joint</u>
6"	27"	19"
8	20	19
10	20	19
12	20	19
14	13	11
16	13	11
18	11	11
20	11	11
24	9	11
30	9	11
36	8	11
42	7	7
48	7	7

- n. When installing a water main, the horizontal separation between water and sewer shall be ten feet. If this separation cannot be maintained due to existing conditions, the only variation allowed is the water main in a separate trench with the elevation of the water main at least 18 inches above the top of the sewer and must be approved by the Public Utilities Director. All distances are measured from outside diameter to outside diameter.
- o. When a water main crosses over a sewer main, there must be eighteen inches of vertical separation. If the water main must go under the sewer main, both these lines must be of ductile iron for a distance of ten feet on either side of the crossing with a twelve-inch vertical separation. The crossing of other underground pipe requires a minimum of twelve inches of vertical separation. Any changes in these clearances must be approved by the Public Utilities Director. All crossings within these vertical clearances shall be filled with #67 stone. All distances are measured from outside diameter to outside diameter.
- p. When a water line passes over or under a storm sewer, vertical separation of 18 inches shall be maintained unless both lines are of ductile iron or encased in concrete. A concrete pad shall be poured between the two. Distances are measured from outside diameter to outside diameter.

- q. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.
- r. All water crossings under the state system roads shall be made in accordance with the requirements of the NC DOT as defined in their encroachment permits.
- s. Where conditions are, in the opinion of the City Inspector unsuitable for laying pipe because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again providing such conditions have been corrected.

15. REACTION BLOCKING

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place, unless otherwise directed by the engineer. The reaction areas required for these thrust blocks shall be given to the contractor by the inspector, and the contractor shall install the blocks according to directions provided by the inspector. Where concrete must be reinforced, the contractor shall furnish such reinforcing as is required.
- b. Required reaction bearing areas will be taken from the schedule herein. See Details W-10 & W-11. Areas given are vertical plans measured in solid material normal to the thrust line of the fitting.
- c. Material for reaction blocking shall be transit-mixed concrete. This concrete shall have a twenty-eight day compressive strength of 2500 psi. Any metal used to resist thrust which is not encased in concrete shall be "hot dipped" galvanized.
- d. Valves on ductile iron lines shall be anchored with thrust collars as shown in Details W-7 thru W-9.

16. BACKFILLING PIPE

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Details W-3 for ductile iron.

Ductile iron pipe shall be backfilled with suitable native material. No rocks, boulders or stone four inches or larger shall be included in the backfill for at least two feet above the top of the pipe.

- b. All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of

the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.

- c. Deficiency of backfill material shall be supplied by the contractor where this deficiency results from any cause other than rejection of unsuitable backfill material (other than rock) by the City Inspector. In cases where the City Inspector directs, the contractor shall dispose of unsuitable backfill material and provide suitable backfill material.

Where excavated material has been rendered unsuitable, either before or after excavation, by inclement weather or type of material, the contractor must correct the moisture or furnish replacement backfill material.

- d. Backfilling shall not be allowed, except with permission of the City Inspector. When a ditch is flooded or the weather is unsuitable, the contractor shall not backfill unless permission is given by the City Inspector. No backfilling with frozen material shall be allowed.

17. SETTING VALVES AND VALVE BOXES

- a. Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement is existing, the box shall be adjusted to finished street grade and a concrete pad two-feet square and six inches thick shall be poured around the box two inches from the top of finished grade as shown in Detail W-17. When valves are located in street rights-of-way, but out of pavement, the boxes shall be adjusted to finished grade and a concrete pad two-feet square and six-inches thick shall be poured around the box one-half inch from the top. When valves are located outside of street rights-of-way, the boxes shall be at finish grade, and a concrete block two-feet square and six-inches thick shall be poured around the box at grade line. Valve locations out of street rights-of-way shall be marked with a metal post having a minimum diameter of two inches and a minimum bury of three feet with a minimum of three feet exposed. The exposed portion shall be painted bright orange and shall be placed so that a valve operating tool has free operation.
- b. When a tapping sleeve and valve are being used, the valve, sleeve and machine assembly shall be air tested to hold at 150 psi for a five-minute duration in the presence of the inspector prior to drilling or tapping the main. All tap coupons shall be given to the city inspector. The valve shall be in the closed position during the testing.

18. SETTING FITTINGS

Fittings shall be set at locations shown on the plans with care being taken to properly "bell-up" joints and support the body of the fitting. All dead-end lines shall be plugged with mechanical joint plugs or caps and anchored by using thrust collars and blocking as shown on Details W-7 thru W-12.

19. SETTING HYDRANTS

- a. Specific directions are required for the setting of all hydrants. In streets where paving is proposed in the near future, the contractor will be given line and grade stakes for hydrants. It is mandatory for the contractor to preserve these stakes for the inspector to verify that the hydrant was set correctly. In areas where paving is not anticipated in the near future, hydrants shall be set according to the inspector's directions. When fire hydrants are installed behind guard rails the breakaway flange will be flush with the top of the guard rail. In general, hydrants shall be located in a manner to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians.
- b. Hydrant installation shall be as shown in Detail W-4 and will be rodded from the main to the hydrant with a maximum one rod coupling. If the distance is greater than 20 feet the hydrant shall be rodded to a thrust block as shown in Detail W-7. When hydrants are used as blow-off assemblies, the valves shall be rodded to a thrust block. Restraining rods and accessories shall be "hot dipped" galvanized.
- c. Before a hydrant is set, all dirt and foreign matter shall be removed from the interior of the hydrant.
- d. Hydrants shall be bagged, to indicate "out of service", until all testing is complete and the mains are placed in service. Bags shall be large enough to cover the entire hydrant and shall be black in color. Bags shall be secured with duct tape at the base of the hydrant and shall be removed immediately after the hydrants are placed in service.

20. SETTING BLOW-OFFS AND RELEASE VALVES

- a. Blow-offs and drainage branches shall not be connected to any sewer, submerged in any stream, or be installed in any other manner that will permit back siphonage into the distribution system.
- b. All air release valves and blow-offs shall be installed as shown on Details W-19 - W-22. Air release valves must be such that provisions can be made by the contractor to get the flow of water to a natural drainage way.

21. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

22. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The sedimentation and erosion control plan and permit shall remain on site at all times. The contractor shall not allow mud and debris to accumulate in the streets. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All measures must be taken so that stormwater runoff does not go to the pipes or manholes of the utility system. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include but not be limited to swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
- c. Permanent erosion control measures shall include but not be limited to swaled easements, rip rap and seeding of disturbed areas.

- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

23. MAINTAINING SERVICE

When replacing or extending water mains, the contractor shall maintain existing water services.

24. GUARANTEE

The contractor shall guarantee all material, equipment and workmanship for a period of at least one-year after final acceptance by the City. The Public Works Department Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

25. WETLAND/STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corps of Engineers. All Neuse Riparian buffers shall be maintained as required by the North Carolina Division of Water Quality.

26. GENERAL WATER MAIN TESTING SEQUENCE

Water mains shall be tested in the following general sequence:

- a) "Pigging" main (mains with gate valves)
- b) Flush the main (all flush water shall be dechlorinated using methods acceptable to the City of Raleigh Public Utilities Department);
- c) Perform the hydrostatic tests;
- d) Introduce the appropriate amount of chlorine by tapping the main;
- e) Hold the chlorine solution in the main for at least twenty-four hours and no more than seventy-two hours;
- f) Flush the main (all flush water shall be dechlorinated using methods acceptable to the City of Raleigh Public Utilities Department);
- g) Sample for the bacteriological tests; and

- h) Water mains shall be placed into service within 48 hours of meeting bacteriological analysis requirements. If no activity is anticipated on a water main for the first 30 days after it is placed into service, the contractor shall notify the City of Raleigh Public Utilities Department at 870-2870.

27. PIGGING

All new mains with gate valves must be pigged with a polyethylene "pig", 5#/cubic foot density at the conclusion of installation.

The pig must be blown at the end of the main by means of the following:

- a) 4" main - 4" blow-off (private only)
- b) 6" main - fire hydrant or 6" blow-off
- c) 8" and 12" through blow-off assembly as on Details W-21 & W-22
- d) 16" – 24" temporary pig retrieving station as approved on plans

The contractor installing the line shall write the name of the company and street name in which the work is taking place on the pig in a manner in which it will not rub off.

28. HYDROSTATIC TESTS

- a. All main installations including private distribution and fire lines to the buildings shall be pressure tested between each main line valve in accordance with AWWA C-600-87. The test shall be performed using a suitable pump and an accurate pressure gauge. Immediately upon completion of a section of main, 150 psi (\pm 5 psi) of pressure shall be applied and held for two hours. The acceptable leakage rate shall not exceed .092 gallons per inch of pipe diameter per 1,000 feet of pipe per hour.

Failure of the water main to comply with the above acceptable leakage rate, shall require the contractor to replace any defective materials to insure a watertight installation. If it is deemed that the existing blowoff valve is the cause of failure, the party responsible for the water main extension shall also be responsible for adding a valve at that location and abandoning the existing valve. After any inadequacies have been corrected, the leakage rate will again be tested. This test shall be repeated until that portion of main is brought to compliance with the permissible leakage rate.

- b. Prerequisite conditions for inspection prior to testing shall be as follows:
 - 1) Hydrants shall be properly located, operable, plumb and at correct elevation.
 - 2) Valves shall be properly located, operable and at correct elevation. Valve boxes or manholes shall be centered over operating nuts, and the top of the box or manhole shall be at proper elevation.

- 3) Lines shall be properly vented where entrapped air is a consideration.

29. CHLORINATION

- a. All additions or replacements to the water system, including fire lines and backflow prevention devices, shall be chlorinated before being placed in service. Such chlorination must take place under the supervision of an inspector.
- b. Pipe subjected to contaminating materials shall be treated as directed by the Public Utilities Department or Engineer. Should such treatment fail to cleanse the pipe, replacement shall be required. The City shall bear no portion of any cost sustained by the contractor in meeting this specification.
- c. Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.
 - 1) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These taps shall be located in such a manner as to allow HTH solution to be fed into all parts of the line.
 - 2) A solution of water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000-foot section of line to produce the desired concentration of 50 ppm.

<u>Pipe Size</u>	<u>Pounds High Test Hypochlorite (70%) Per 1000 Feet of Line</u>
6"	0.88
8"	1.56
10"	2.42
12"	3.50
14"	4.76
16"	6.22
20"	9.76
24"	14.00
30"	21.00
36"	31.50
48"	56.00

- 3) The HTH solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains.
- 4) Services shall be sterilized by methods acceptable to the Public Utilities Director or Engineer, and the contractor shall have the same responsibility for laterals as for mains in regard to bearing full cost of any corrective measures needed to comply with bacteriological or other requirements.
- 5) HTH solution shall remain in lines for no less than twenty-four hours, unless otherwise directed by the Public Utilities Director or Engineer.
- 6) Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.

30. BACTERIOLOGICAL SAMPLING

- a. Free residual chlorine after twenty-four hours shall be at least 10 ppm, or the Public Utilities Department or Engineer will require the the lines be rechlorinated.
- b. Mains will be flushed with a blow-off assembly of sufficient size to effectively clean the main. Detail W-22. Flushing of lines may proceed after twenty-four hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until chlorine returns to normal level. In times of water shortages or distribution main problems, the flushing operation may be delayed. The Public Utilities Department shall determine when flushing is allowable. The contractor shall advise the inspector prior to the chlorination and flushing so that the inspector can advise the Public Utilities Department of the construction location, size and length of mains. All tests will be done in the presence of an inspector. Flushing will be for short duration. Sufficient precautions must be taken to the satisfaction of the inspector to ensure that the impact of the water is absorbed and the water is conveyed without erosion or property drainage. All flush water shall be dechlorinated using methods acceptable to the City of Raleigh Public Utilities Department.
- c. After flushing is completed, the Public Works Department (or their designee) shall collect samples for turbidity and bacteriological analysis for each section of pipe between main line valves. Sample point locations shall be determined by a representative of the engineer or owner. A custody seal shall be placed on each set of turbidity and bacteriological bottles. A chain of custody form must be completed for sample set(s) collected and must be delivered along with the sample(s). A turbidity test will be done. If the turbidity exceeds 1 NTU, the sample fails and a

bacteriological test will not be set up. The Public Utilities Department will perform the turbidity and bacteriological analysis.

- d. Samples will be accepted between 8:00 AM and 12 NOON and 1PM and 3:30 PM Monday through Thursday, excluding holidays. Special arrangements may be made for samples to be accepted outside of this time frame by calling the laboratory in advance.
- e. In the event that two successive bacteriologic tests fail, that section of the main shall be rechlorinated by the contractor and new tests performed prior to moving to the next section of main.

31. SERVICE CONNECTIONS

- a. Taps shall be made only on a line under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization from the engineer is obtained.
- b. Taps shall be at an angle of forty-five degrees to a perpendicular plane through the center line of the pipe as shown is in Detail W-23.
- c. The maximum size of a direct tap shall be 1" for mains 6" and larger. Larger taps may be made by using a service saddle.
- d. Services larger than two inches shall be made by using a tapping sleeve and valve. The service line from the main shall be:

4-inch D.I. for 4-inch services;
6-inch D.I. for 6-inch services; and
8-inch D.I. for 8-inch services.

The typical tapping sleeve and valve is shown in Standard Detail W-14.

- e. No taps or services shall be made on the 24-inch or larger transmission mains.
- f. Before any water services are installed, the main shall be thoroughly flushed using a flow velocity sufficient to scour the pipe interior. All flush water shall be dechlorinated using methods acceptable to the City of Raleigh Public Utilities Department.
- g. Each meter yoke shall be flushed before the installation crew proceeds to the next service installation.

32. WATER MAIN AND SERVICE ABANDONMENT

Contractors abandoning water services shall remove the entire service including the corporation cock and insert a plug in the main. When plugging the line is not available, the corporation cock may be turned off, capped, and surrounded with 1

ft³ of concrete. All remaining portions of the service shall be removed from the main to the right of way line and shall be disposed of properly. Water main abandonment must be performed in accordance with a plan approved by the Public Utilities Department. Service and main abandonment require inspection by the Public Works Department at 890-3030.

33. SEALED AS BUILT PLANS

Certified surveyed "As built" plans and profiles, sealed by a Professional Land Surveyor, shall be furnished to the Public Works Department by the Engineer upon completion and acceptance of the public main by the City and completion of private systems. The surveyed "as built" plans shall have North Carolina Geodetic Survey grid coordinates to all meter boxes, valves, manholes, and mains along with the depth information. The water permit number information must also be included. Surveyed "As built" plans of installed utilities shall be furnished to the City prior to issuance of the letter of acceptance. All service stubs shall be shown on the surveyed "as built" plans.

Certified surveyed "As Builts" should be provided in a digital format. The digital file of utilities needs to show the overall water and sewer system layout along with the property or subdivision boundaries and connecting manhole. The water distribution system drawings should show mains sizes, material, hydrants, valves, blow-off assemblies, and any other relevant information (backflow preventers, air release valves, etc.). The digital file should be delivered in DXF format. If this is not possible, then, DWG, DGN, and SHP are also acceptable formats.

34. GENERAL ACCEPTANCE

The developer or his representative must notify the Public Works Departments' Engineering Inspector, in writing, before installation and for scheduling inspection. Once the project is complete a punch list and inspection is scheduled noting any deficient items. Once the deficient items are repaired and/or replaced to meet City standards and specifications the developer or his/her representative shall submit the following items to the City's Public Works Department.

- a. A professional engineer's certified statement of the cost of the public utilities installed.
- b. A professional engineer's certified statement indicating that the work has been built in accordance with the approved set of construction plans.
- c. A release of liens statement from the owner/developer stating that all materials and workmanship associated with the water main has been paid in full.
- d. Certified surveyed "As-Built" plans and profile shall be furnished by the engineer upon completion and acceptance by the City as stated above.

- e. The developer is responsible for ensuring a one-year written warranty to the City prior to issuance of the letter of acceptance.
- f. The developer and/or engineer shall provide a recorded map to the City of Raleigh showing all public rights-of-way and easements.
- g. The engineer shall keep a copy of the “as-built” plans on file indefinitely.

CONSTRUCTION SPECIFICATIONS FOR SEWER MAINS

As part of the requirement to obtain construction approval for sewer main extensions, the engineer shall affix the appropriate permit sticker(s) to the original drawings. The various stickers are shown at the end of the Policies/Regulations section of this book.

The requirements contained in this section shall apply to sanitary sewer main installations constructed for the Public Utilities Department or for private developers who may or may not dedicate the sewer improvements to the City. All necessary construction permits must be obtained before construction may begin in accordance with the North Carolina State Law. A sewer plug permit must also be obtained.

Any Contractor performing work within the City of Raleigh or City of Raleigh Merger Areas such as Garner, Wake Forest, or Rolesville, shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, backfilling of sewer mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at 857-4540 and Engineering at 890-3030 and give the location, project name, individuals name, company name, start date and indicate if it involves a sewer extension and state the start date. Contractor's must call the Public Utilities Inspections staff at 250-2737 at least twenty-four hours in advance for an inspection in the Garner, Wake Forest, or Rolesville Utility area.
- c. Once construction has begun, the contractor shall contact Public Works at 890-3030 each morning by 9:00 a.m. to notify where and what will be done that day. The City requires a 24 hour notice prior to an inspection. Any work requiring inspector's observation outside of the normal workday, shall be charged at the current inspector hourly rate.
- d. If a developer, engineer or contractor proceeds with the main installation prior to permit issuance the City requires the work to be reinstalled and the developer, engineer or contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).
- e. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities

Department, reviewed and approved. Therefore, the contractor that proceeds with construction prior to this approval is at his/her own risk.

2. GENERAL TESTING REQUIREMENTS

- a. The City may perform and shall require the contractor to perform, such destructive and nondestructive testing, as it deems necessary in order to inspect the materials and workmanship. See specific testing requirements within this section. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-cone method and/or nuclear testing gauges.
- b. All new sanitary sewer mains must be cleaned to the satisfaction of the inspector by jetting or balling prior to final inspection and acceptance by the City.
- c. Prior to final inspection all sanitary sewer mains shall be camera inspected. In areas where the manholes are installed within the street, the camera inspection shall take place just prior to the final lift of surface course asphalt. Failed inspections will require a follow up inspection and subsequent reinspection fee.

3. SEWER CONSTRUCTION PLUGS

- a. A sewer plug permit must be obtained prior to beginning construction. See General Policies and Regulation Section for application.
- b. Mechanical plugs (non-pneumatic) must be installed throughout the time of construction of any sanitary sewer extension. Plugs are to be installed on the downstream end of the new main at the first manhole from the existing tie-in, until final acceptance.
- c. All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility contractor to whom the plug belongs.
- d. All plugs must be monitored during construction to insure the plug is functioning as required.
- e. Prior to removing the plug, the contractor must sign a plug removal form verifying that the sewer facilities are sufficient and functionally complete. All plugs must be removed by the contractor upon acceptance that the sewer facilities are sufficiently functionally complete to accept flow and PRIOR to the mains above the plug location being placed into service and/or accepting any flow of sewage.

4. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all sewer materials. Any material which is damaged or defective shall be replaced by the contractor at the contractors' own expense.
- b. The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations. All PVC sewer pipe shall be protected from the sun's ultra violet rays if stored on the job site longer than twenty days.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for sewer and water mains shall be repaired in a manner approved by the City. Machined manhole frames and covers shall remain intact until construction is complete.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and professional manner to prevent injuries, during and after working hours, until the project is complete.

5. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of sewer mains.
- b. Detours shall be set up and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and North Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights and

other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because the detour is approved by others.

- c. Construction work zone signs and signing procedures shall conform to the MUTCD and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's Transportation and Inspections Departments for all work to be performed in the public rights-of-way.

6. PROPERTY PROTECTION

Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction. Existing manholes within the work zone and outside of the pavement shall be protected by orange safety fence.

7. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state and local ordinances, laws and regulations as related to safe construction practices and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for contractors adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall furnish safety equipment necessary to inspect the work including, but not limited to ladders, gas detectors/oxygen sensors, blowers, etc.

8. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from NCDOT when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local and state and federal permits required for the utility construction. The contractor must have an approved set of permitted construction plans on site at all times.

9. PAVEMENT REMOVAL AND REPLACEMENT

- a. All pavement to be removed shall be cut along straight lines with the appropriate saw cut machine. A street cut permit is required. The removal and replacement of the pavement shall conform to the information shown in Details S-1 thru S-4.
- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Notes 2 and 3 of details S-3 & S-4.
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details S-4 & S-5, plus six inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

10. CONSTRUCTION WATER

The City of Raleigh Public Utilities Department does not provide free or otherwise unmetered construction water for any construction project. Hydrant meters may only be moved with the express written permission of the Public Utilities Department. In residential areas hydrant meters may only be used for the filling of swimming pools unless prior approval of the Public Utilities Department. Contractors are responsible for adequate construction water for their job sites in one of the following approved manners:

- a. Apply for permanent water service connection at the Inspections Department Permit Office, 4th floor, Raleigh Municipal Building, 222 West Hargett Street, (890-3450). Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.
- b. Apply in person with the Public Utilities Meters Division Office, 3304 Lake Woodard Drive, for rental of a hydrant meter. There are a limited number of these meters and they are reserved in advance by contacting the Meters Division (250-2797). A deposit is required along with a per month rental fee per account plus the cost of the water used, at the outside City rate. Hydrant meters are read in 100 cubic feet (ccf). There is a minimum rental fee and an administration fee for billing and closing an account. A service charge is charged when accounts are closed. Customers are responsible

for notifying the Meters Division if the meter is not registering usage. The following information is required:

- (1) Meter location;
 - (6) Billing address, telephone number, responsible party name, and federal tax id#
 - (7) Location of hydrant;
 - (8) Water to be used for;
 - (9) Duration of use and frequency of meter reading,
 - (6) Meters must be brought to the Utilities Operations Center for monthly reading.
- c. Upon application approval, the City shall install hydrant meters and approved backflow prevention devices on the fire hydrant requested by the customer, but acceptable to the City, within three (3) business days of the application and deposit being received.
- d. Hydrant meters accounts are billed monthly. Failure to report usage in timely manner for billing or accounts that are not paid in full will result in the loss of water service and the closing of the account with the City.
- e. Hydrant meters will only be set when the temperature is over 35 degrees. Damage to meters from the cold weather or abuse will be charged to the customers.
- f. Hydrant meters used for long term use shall be returned at the end of every one year block for inspection.
- g. Upon completion of hydrant usage, deposits shall be refunded to customers within 30 days provided the following has occurred:
 1. Hydrant meter and backflow device have been returned in good condition, with no excessive wear nor damage.
 2. All outstanding water usage charges and rental charges for the meter and backflow device have been paid in full by the customer.
- h. The cut off to apply for new accounts is 3:00 PM each business day.
- i. It is a violation of the City Code to establish a direct connection to a fire hydrant to fill a tank or tank vehicle. It is also illegal to use a RP or Double detector check valve on a domestic or fireline service for temporary water service. Violations of the City Code will result in loss of service, fines, and other measures as specified by the Code.
- j. Continued use of a hydrant meter, when usage readings are not being registered is considered theft of City water and subject to civil penalties of \$500.00/day. It is the responsibility of the customer to notify the Meters Division at 250-2737 when the meter is not registering/recording the water usage properly.

- k. Hydrant meters and backflow assemblies approved for use in this program is the property of the City of Raleigh Public Utilities Department. Failure to return the hydrant meter and backflow preventer at the end of the rental period will be considered theft of City property and prosecuted to the fullest extent of the law.

Note: Individuals caught using water unmetered and/or unauthorized by the Public Utilities Department will be prosecuted to the fullest extent of the law.

11. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division (250-2737).
- b. Trench width shall be a minimum of twelve inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless additional trench width is required by OSHA. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Details S-4 & S-5.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly tamped.
- d. The maximum length of open trench shall be no more than three-hundred feet unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at the contractor's own expense, keep all trenches free from water during the excavation for construction of sewer mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property or the work in progress. Erosion control measures shall be taken during this pumping.
- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.

- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Transportation Director, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- h. Sheeting or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheeting shall conform to AASHTO and OSHA safety standards. The decision of the Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls

12. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding $\frac{1}{2}$ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done after coordination with the City Inspector and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The contractor shall keep the explosive materials that are on the job site in specially constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.

- 1) Date of shot
 - 2) Time of shot
 - 3) Crew Supervisor
 - 4) Number and depth of holes
 - 5) Approximate depth of overburden
 - 6) Amount and type of explosive used in each hole
 - 7) Type of caps used (instant or delay)
 - 8) The weather
 - 9) Seismograph instrument and readings
- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to save the City of Raleigh harmless from any claims.

13. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and shored so that workers may work safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system. See erosion control section for appropriate siltation prevention measures prior to pumping.
- b. The width and type of trench may vary with the depth of cut, and the trench shall be constructed in accordance with the dimensions and other information shown on Details S-4 & S-5.
- c. Pipe Clearance in rock shall be a minimum of six inches on each side and bottom for mains fifteen inches in diameter and less. For larger size mains, the minimum clearance shall be nine inches on the sides and bottom.
- d. If unstable conditions are encountered, the trench shall conform to the requirements as stated in this Handbook.

14. PIPE INSTALLATION

- a. The pipe material listed above shall be installed in accordance with the manufacturer's recommendations and the requirements of these specifications.
- b. All sewer mains and manholes shall be laid to the line and grade shown on the plans.

- c. No deviations from line and grade shall be made, unless they have been approved by the Public Utilities Department or Engineer and identified on the "as-builts".
- d. The sewer pipe installation shall start at the outlet end and proceed upstream to the termination of the project as shown on the plans. The bell ends shall point upstream. Exceptions to this provision will be considered on a case by case basis, when requested in writing by the owner of the development at the time engineering construction plans are submitted to the City for review and approval. The development owner must agree to hold the City harmless. He must accept full responsibility for compliance with state and federal regulations of the Clean Water Act, including any associated penalties which could reach up to \$25,000/ day, for the release of wastewater from sanitary sewer to the environment, which are not connected to existing sewer due to the granting of an exception to the pipe laying sequence required in the Public Utilities Handbook. The development owner must further agree to not request building permits, if an exception is granted for that portion of the development, until connecting sewer is constructed and accepted by the City.
- e. While working on any part of an existing sewer main, the contractor shall maintain the existing sewage flow. No discharge of sewage to the storm waters will be allowed. Water for the flushing of new sanitary sewer mains must be obtained through a fire hydrant meter and must be pumped out and may not be discharged into the sanitary sewer system. Construction requiring existing sewer flow to be pumped from existing manholes shall be the responsibility of the contractor and must be approved prior to proceeding by the Public Utilities Director or the City Inspector.
- f. After the trench foundation has been properly graded with bell holes, the pipe shall be carefully lowered into the trench with approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe shall be properly repaired or replaced at the contractor's expense.
- g. The pipe interior shall be kept clean before and after laying by means approved by the Public Utilities Director or Engineer. Pipe ends shall be plugged at the end of each workday or when work is temporarily stopped. The plugs shall be watertight so the water and debris will be kept out.
- h. When a sewer main passes over or under a storm sewer pipe, and the vertical separation is less than 18 inches, a concrete pad shall be poured between the two.
- i. When installing a sewer main, the horizontal separation from any water main shall be ten feet. If this separation cannot be maintained due to existing conditions, the variation allowed is the water main in a separate trench with the elevation of the water main at least 18 inches above the top of the

sewer and must be approved by the Public Utilities Director. All distances are measured from the outside diameter to outside diameter.

- j. When a water main crosses over a sewer main, there must be eighteen inches of vertical separation. If the water main must go under the sewer main, both these lines must be of ferrous material for a distance of ten feet on either side of the crossing with a 18-inch separation. The crossing of other underground pipe requires a minimum of twelve inches of vertical separation. Any changes in these clearances must be approved by the Public Utilities Director. All crossings within these vertical clearances shall be filled with #67 stone. All distances are measured from outside diameter to outside diameter.
- k. When a sanitary sewer main is crossing over or under a storm sewer a vertical separation of 18 inches shall be maintained unless both lines are of ductile iron or encased in concrete. Distance measured outside diameter to outside diameter.
- l. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.
- m. All sewer crossings under state system roads shall be made in accordance with the requirements of NC DOT as defined in their encroachment permits.
- n. Where conditions are, in the opinion of the Public Utilities Department or Engineer, unsuitable for laying pipe because of weather or trench conditions, the Contractor shall be required to cease work until permission is given by the Public Utilities Director or Engineer for work to commence again, providing such conditions have been corrected.

15. LAYING REINFORCED CONCRETE SEWER PIPE

- a. Pipe support for reinforced concrete sewer pipe shall provide uniform bearing for the pipe barrel along its entire length. Particular care shall be taken to compact soil under and around the curve of the pipe to give maximum support. Select soil compacted to 90% of maximum Proctor Density shall reach to a point one foot above the top of the pipe. The remainder of the soil to the surface of the ground shall be compacted to specified density in accordance with Detail S-4.
- b. Pipe bedding classes for reinforced concrete pipe (as defined for these specifications) shall be as follows, and it shall be mandatory for the contractor to employ the correct bedding within the limits defined in the bedding tables included herein.
 - 1) Class D bedding is that condition existing when the trench bottom is excavated slightly above grade and cut to finished grade by hand.

Bell holes are dug, and the pipe bears uniformly along its entire length. See Detail S-1 & S-4.

- 2) Class C bedding is that condition existing when the trench bottom is undercut a minimum of four inches below the pipe bell and filled with #67 stone to the pipe grade in such a manner that the pipe will be bedded in stone to a vertical height equal to $\frac{1}{6}$ the outside diameter of the pipe barrel. See Detail S-1 & S-4.

16. LAYING PVC GRAVITY SEWER PIPE

The foundation for PVC gravity sewer pipes shall be a firm flat bottom trench of 4 inches of Class I material as defined in ASTM D2321-89(1995) compacted with bell holes. See Details S-2, S-3, & S-5. Class II material may be used if contractor can verify that this type of soil is native to the site by having soil tests made by a soil testing agency. Sample borings shall be taken on 200 foot intervals and to a depth equal to or greater than the trench bottom shown on the plans. The results must be approved by the Public Utilities Director prior to pipe installation.

17. LAYING DUCTILE IRON SEWER PIPE

- a. Ductile iron pipe shall be installed in accordance with the requirements of AWWA Standard C-600-87. See Detail S-4.
- b. Sewer pipe shall be laid to the line and grade shown on the plans. There shall be a minimum horizontal separation between water and sewer utilities of ten feet and a vertical separation of 18 inches.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made on revised plans upon approval by the Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.
- f. Depth of pipe cover, unless shown otherwise on the plans shall be a minimum of three feet outside of travelways and five feet inside of travelways. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe.

- g. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job. All damaged pipe shall be replaced at the expense of the contractor.
- h. Laying of pipe and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed.
- i. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.
- j. Bell ends will face the direction of laying which must be upgrade unless otherwise directed by the Public Utilities Director or Engineer.
- k. Where conditions are, in the opinion of the City Inspector, unsuitable for laying pipe because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again providing such conditions have been corrected.

18. SEWER LATERALS

- a. Pipe for 4 inch sewer laterals shall be PVC pipe, DIP or CIP. Where installation by boring is specified, four-inch ductile iron pipe shall be used. DIP or CIP (4" only) must be used for deep or shallow installations under the same standards as sewer mains. Aerial service installations shall be constructed of 4" DIP. A minimum grade of 1% shall be maintained with four and six-inch pipe. Each lateral shall be sealed at the end with an approved watertight plug. Lateral installation for four-inch services shall conform to Standard Detail S-30. A six-inch service lateral must connect to a manhole. All laterals shall be left exposed until the inspectors can verify the installation of each plug.
- b. Each sewer lateral shall be installed from the main to the street right-of-way line where a one piece combination wye and 1/8 bend and cleanout stack will be installed. The wyes on the laterals shall be sealed at the property line with a permanent plug.
- c. Trench support, bedding and backfill for laterals shall conform to the same specifications as those for sewer mains. The contractor shall properly backfill under all wye and lateral connections at the main. The lateral connection at the main shall be backfilled with #67 stone.

- d. Where laterals are bored, the face of the bore cut shall be a distance of five feet from the edge of the pavement on either side, unless approval to the contrary is given by the Public Utilities Director.
- e. Sewer laterals four inches in diameter shall be connected to the main by means of an in-line wye or a tap and saddle, installed over a hole cut in the top quadrant of the main at an angle of forty-five degrees, with respect to direction of flow. The hole shall be cut with a mechanical circle type saw cutter designed for the particular use and rendering a smooth, uniform cut with no damage to the main and which retrieves the coupon. The PVC saddle installations is shown on Standard Details S-31 .
- f. All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes in accordance with Details S-31 and S-32. Taps can only be made by using a mechanical tapping machine or other approved device. All sanitary sewer service connections 6 inches and larger shall be made into manholes only. Service connections on mains 15 inches and larger are only allowed at manholes. Service clean-outs shall be located at the right-of-way line or the easement boundary line. The maximum vertical drop for a 6-inch service into a manhole shall be 10 feet.
- g. All laterals tapped on newly constructed mains shall be air tested with the main. All laterals tied to a newly constructed manhole shall be vacuum tested with the manhole or conduct a separate air or water head test before any plumber connections are made.

19. MANHOLES

- a. Manhole dimensions shall conform to those shown on Detail S-24. Manholes on all lines twelve inches in diameter or smaller shall have an inside diameter of four feet.
- b. Inverts shall be constructed with a width equal to that of the effluent pipe, height to the springline and invert "shelves" from that point upward at 60 deg. to manhole walls, it shall be so brushed and troweled that a minimum energy loss occurs in the manhole from invert roughness. The maximum grade on an invert of less than 2.5 feet shall be no greater than 6 inches across the manhole. "Bowl" shaped inverts shall not be allowed in the sanitary sewer collection system.
- c. Foundation for manholes shall be in accordance with Detail S-21, unless approval to the contrary is given by the Public Utilities Director.
- d. All manholes in road right-of-ways will be flush with grade not withstanding 100 year flood requirements. In easements, manholes will be a minimum of 12 inches above ground.
- e. All new manholes must be vacuum tested in accordance with the procedure.

- 1) The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All equipment will be approved for vacuum testing.
- 2) All lifting holes shall be plugged with an approved non-shrink grout.
- 4) All pipes entering the manhole shall be plugged. The contractor shall securely brace the plugs to keep them from being drawn into the manhole. All service connections tied to manholes shall also be vacuum tested with the manholes.
- 5) The test head shall be placed inside the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.
- 6) The vacuum testing equipment shall be manhole vacuum tester as manufactured Cherne Manhole Testing or approved equal. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. Inflate the compressor band to effect a seal between the vacuum base and the manhole cone section. Connect the vacuum pump to the outlet port with the valve open. With the valves closed, the time for the vacuum to drop to 9-inches of mercury shall not be less than that shown in the following table.

<u>Manhole Depth</u>	<u>Diameter of Manhole</u>		
	<u>48"Dia.</u>	<u>60"Dia.</u>	<u>72"Dia</u>
10 Ft. or Less	60 Sec.	75 Sec.	90 Sec.
>10 Ft. but<15 Ft.	75 Sec.	90 Sec.	105 Sec.
>15 Ft.	90 Sec.	105 Sec.	120 Sec.

(Times shown are minimum elapsed times for a drop in vacuum of 1-inch of mercury).

- 7) If the manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed and continue until a satisfactory test is accomplished.
- f. All manhole rings on manholes other than flat-tops shall be bolted to the cone section and sealed down with asphaltic cement or "ram-neck. See Detail S-25.
 - g. All manhole joints must be waterproofed with asphaltic cement or "ram-neck". All exterior joints shall be wrapped with a butyl resin sealant of 8" width.

- h. All main and service pipe connections into manholes must be cored with a concrete coring machine and the pipe connection must be made with a flexible rubber boot.
- i. Adjustment rings used within streets shall be fixed with mortar or a urethane based manhole joint seal by A.I.T. or approved equal.

20. BACKFILLING

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Details S-4&S-5 for the various pipe materials.
 - 1) RC pipes shall be backfilled with suitable native material. No rocks, boulders and stones larger than four inches shall be included in the backfill for at least four feet above the top of the pipe and no rocks larger than 12 inches in the rest of the backfill. See Details S-4 & S-5.
 - 2) The haunching for PVC pipes shall be with #67 stone (Class I material) 4 inches below and up to the springline of the pipe. Care shall be taken to work the haunching well under the bottom of the pipe. The initial and final backfill shall be with suitable native material. No rocks, boulders or stones four inches or larger shall be included in the backfill. The haunching shall be tamped to 95% standard Proctor density in six-inch lifts.
 - 3) For PVC sewer installations, Class II material may be allowed for the bedding, housing and initial backfill if the contractor can verify that this type of soil is native to the site by having soil tests made by a soil testing agency. Soil sample borings shall be taken as directed by the City inspector to a depth equal to or greater than the trench bottom elevation shown on the plans or in the specs. The results must be approved by the Public Utilities Director prior to pipe installation. The bedding and backfilling shall be in conformance with ASTM standards and the various soil classes are defined below:
 - (a) Class I - Angular, 6 to 40mm (1/4 to 1 1/2 inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shells.
 - (c) Class II - Coarse sands and gravels with maximum particle size of 40mm (1 1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. (GW - well graded gravel, GP - poorly graded gravel, SW - well graded sand, SP - poorly graded sand.)

- (c) Class III - Fine sand and clay type gravels, including fine sands, sandclay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class. (GM - silty gravel, GC - clayey gravel, SM - silty sand, SC - clayey sand.)
 - (d) Class IV - Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding, haunching or initial backfill on PVC pipes. (MH - silty soil with high liquid limit, ML - silty soil with low liquid limit, CH - clayey soil with high liquid limit, CL - clayey soil with low liquid limit.)
- b) All backfill shall be compacted in six-inch lifts measured from the foundation to one foot above the top of the pipe and then in twelve-inch lifts to the top of the trench when in easements. Sewer mains in street rights-of-way shall be compacted in six-inch lifts all the way to the top of the trench.
- c) Material for backfilling shall be approved by the inspector. In areas where settlement or bearing capacity are not a major consideration, the engineer may give permission for a low grade of material to be backfilled from a point two foot above the top of the pipe, but in no event will excavated rock larger than four inches at any point be used for backfill material.
- d) Where backfill material is unsuitable, in the opinion of the Public Utilities Director or Engineer, the contractor may be directed to dispose of the unsuitable material and provide material suitable to the Public Utilities Director or Engineer.
- e) All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.

21. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

22. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The contractor shall not allow mud and debris to accumulate in the streets. The sedimentation and erosion control plan and permit shall remain on site at all times. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include but not be limited to swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
- c. Permanent erosion control measures shall include but not be limited to swaled easements, rip-rap, and seeding of disturbed areas.

- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

23. MAINTAINING SERVICE

When replacing or extending sewer mains, the contractor shall maintain existing service to all property being served.

24. GUARANTEE

The contractor shall guarantee all material, equipment and workmanship for a period of at least one year after final acceptance by the City. The Public Works Department's Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

25. WETLAND/ STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corp of Engineers. All Neuse Riparian buffers shall be maintained as required by NCDWQ.

26. TEST AND INSPECTION

- a. Sewer lines shall be visually inspected from every manhole by use of mirrors, television cameras or other devices for visual inspections, and the lines shall exhibit a fully circular pattern when viewed from one manhole to the next. Lines which do not exhibit a true line and grade and have structural defects shall be corrected to meet these specifications. Manholes that are installed within the street shall be camera inspected just prior to the final lift of surface course asphalt.
- b. Sewer lines will be tested by using the low pressure air test. Sewer laterals will be tested along with the main. It is imperative that proper plugs be installed on the laterals at the cleanout stack. All plugs should be properly installed to withstand the test pressure. Mechanical plugs must be installed throughout the time of construction of any sanitary sewer extension, until final acceptance. All plugs must be securely tied off with steel cable within the manhole and must have a secure marking attached to the plug indicating the utility contractor to whom the plug belongs. All plugs must be removed by the contractor upon acceptance that the sewer facilities are sufficiently functionally complete so as to accept flow and PRIOR to the mains above the plug location being placed into service and/or accepting any flow of sewage.

- c. The low pressure air test in accordance with ASTM F1417 or C924 (F1417 for PVC and Ductile; C924 for Concrete Pipe) will be used on all mains and laterals. Prior to testing, the main shall be clean of debris (to the satisfaction of the inspector) and flushed with water. In doing the air test, it is necessary that plugs be secured properly and braced. In doing the air test, no person will be allowed in the main while it is pressurized. The line is to be pressurized to 4 psi initially and stabilized. After stabilization, the pressure will be decreased to 3.5 psi, and the inspector will determine how long it takes for the pressure in the line to drop to 2.5 psi.

To simplify the ASTM procedure, use the following table to determine the test time. If there are multiple sizes, add the various times together.

<u>Normal Pipe Size</u> <u>(inches)</u>	<u>Time (t)</u> <u>Minutes/100 ft.</u>
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3

If the pressure stays between 3.5 and 2.5 psi for the test time length, the pipe is acceptable. If not, the section is not properly installed. Correct and retest.

- d. All tests shall be made in the presence of the contractor or his representative and the Public Utilities Director, City Inspector or Engineer.
- e. Materials and construction methods called for in these specifications are of such nature as to insure maximum protection for the sewer from infiltration. The contractor shall be responsible for the sewer conforming to the above limits for a period of one year from the date of final acceptance.
- f. When sanitary sewer services are installed as a part of the same approval of the sanitary sewer mains, such as in new subdivisions/annexation areas, the air test of the sewer mains shall be performed with the services and clean-outs in place. Services tied to a newly constructed manhole shall be vacuum tested with the manhole. Services not tested with newly

constructed mains or manholes shall have a separate air test before any plumber connections are made.

27. DEFLECTION TESTING FOR PVC SEWER PIPES

No sooner than thirty days after final backfill installation, a deflection test shall be executed on the sewer line. The maximum allowable deflection shall be five percent for PVC sewer pipes. The test shall use a minimum of nine pronged mandrel pulled through the pipe. The mandrel size shall be calculated by $(1 - \text{allowable deflection percent}) \times (\text{Base Inside Diameter})$. The base inside diameter is the diameter as identified in the shop drawing or advertised pipe literature. It shall not include any additional reduction pipe diameter due to manufacturing tolerances.

The contact length of the mandrel shall be at least eight inches.

Any lines not meeting this test shall be corrected by the contractor and the test repeated.

28. SEWER MAIN AND SERVICE ABANDONMENT

Sewer services to a main shall be abandoned by removing the saddle and replacing the saddle with a 360 degree stainless steel sleeve. The remaining portion of the sewer service shall be removed from the main to the right of way line and shall be disposed of properly. Sewer main abandonment must be performed in accordance with a plan approved by the Public Utilities Department. Service and main abandonment require inspection by the Public Works Department 890-3030.

29. SEALED AS BUILT PLANS

Certified surveyed "As built" plans and profiles, sealed by a Professional Land Surveyor, shall be furnished to the Public Works Department by the engineer upon completion and acceptance of the public main by the City and at completion of private systems. The surveyed "as built" plans shall include accurate information regarding pipe size, pipe material, pipe length, manhole size, invert and top elevations and accurate alignment and location of the constructed sewer mains, manholes and services and all other information included on the original design plans. The surveyed "as-built" plans shall have North Carolina Geodetic Survey grid coordinates to all manholes and mains along with the depth information. The sewer permit number will also be provided on the plans. The surveyed "as built" plans shall be supplied to the Public Utilities Department at the issuance of the letter of acceptance. All service stubs shall be shown on the surveyed as built plans.

Certified surveyed "As Built" plans for sewer shall be provided in a digital format for utilities. The digital file needs to show the overall sewer system layout along with the property or subdivision boundaries and connecting manhole. The sewer collection system should show main sizes, material, manholes, rim and invert elevations and any other relevant information (pump stations, force mains,

siphons, clean-outs, etc.). The digital file should be delivered in DXF format. If this is not possible, then DWG, DGN and SHP are also acceptable formats.

30. GENERAL ACCEPTANCE

The developer or his representative must notify the Public Works Department's Engineering Inspector, in writing, before installation and for scheduling inspection. Once the project is complete a punch list and inspection is scheduled for deficient items. Once the deficient items are repaired and/or replaced to meet City standards and specifications the developer or his representative shall submit the following items to the City's Public Works Department.

- a. A professional engineer's certified statement of the cost of the public utilities installed.
- b. A professional engineer's certified statement indicating that the work has been built in accordance with the approved set of construction plans.
- c. A release of liens statement from the owner/developer stating that all materials and workmanship associated with the sewer main has been paid in full.
- d. Certified surveyed "As-Built" plans and profile shall be furnished by the engineer upon completion and acceptance by the City as stated above.
- e. A statement from the developer ensuring a one year written warranty to the City prior to issuance of the letter of acceptance.
- f. A recorded map to the City of Raleigh showing all public rights-of- way.
- g. The engineer shall keep a copy of the "as-built" plans on file indefinitely.

31. SEWER BACKWATER VALVE

Pursuant to NC State Plumbing Code, homes and other buildings constructed with sanitary sewer drains at an elevation of one (1) foot above the next upstream manhole in the sanitary sewer collection system or lower must be equipped with a sewer backwater valve, installed at a location where it can be maintained. See Details S-38 & S-42.

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REUSE CONSTRUCTION STANDARDS (Public and Private Systems)

As part of the requirement to obtain construction approval for reuse main extensions, the engineer shall affix the appropriate permit sticker(s) to the original drawings. The various stickers are shown at the end of the General Policies/Regulations section of this book.

The requirements contained in this section shall apply to reuse main installations constructed for the Public Utilities Department or for private developers who may or may not dedicate the reuse improvements to the City. All necessary construction permits must be obtained before construction may begin in accordance with North Carolina State Law.

Any contractor performing work within the City of Raleigh or City of Raleigh Merger Areas such as Garner, Wake Forest, or Rolesville, shall have on each job site a copy of these specifications.

1. SCOPE OF WORK

- a. The contractor shall furnish all materials, equipment, and labor for excavation, installation, and backfilling of reuse mains and related appurtenances as shown on the plans. The Public Works Department and/or Public Utilities Department shall conduct all City inspections on reuse main extension projects.
- b. It shall be the contractor's responsibility to notify the Public Utilities and Public Works Departments at least twenty-four hours in advance of beginning any construction work on any project. The contractor must call the Public Utilities Department at (919) 857-4540 and Public Works at (919) 890-3030 and give the location, project name, individual's name, company name, start date, and indicate if it involves reuse extensions.
- c. Contractor shall contact the Public Works department at 890-3030 by 4:15 PM each day to notify where and what will be done the following day. Any work conducted in Garner, Wake Forest, Rolesville, or outside the City of Raleigh Service Area shall contact the Public Utilities Department at 250-2737 by 4:15 PM to notify where and what will be done the following day. Any work requiring inspector observation outside of the normal workday, Monday-Friday, 7:30 a.m. to 4:15 p.m. will be charged to the contractor at the current inspector hourly rate.
- d. If a developer, engineer, or contractor proceeds with the reuse main installation prior to permit issuance, the City may require the work to be reinstalled and the developer, engineer, or contractor shall be fully liable for all actions and costs, including prosecution by the City or the State for proceeding with installation prior to issuance of appropriate permit(s).
- e. "Field changes" are not considered approved by the Public Utilities Department unless revised plans have been submitted to the Public Utilities Department, reviewed, and approved. Therefore, the contractor that proceeds with construction prior to this approval is at his/her own risk.

- f. No one shall make any changes to the reuse system with prior approval from the Public Utilities Department. Any changes to existing facilities, whether intentional or unintentional, shall be reported immediately to the Public Utilities Department at (919) 857-4540.

2. GENERAL TESTING REQUIREMENTS

The City may perform and shall require the contractor to perform such destructive and nondestructive testing as it deems necessary in order to inspect the materials and workmanship. These tests shall be in accordance with the procedures established by ASTM and AASHTO. The City shall reserve the right to modify the procedures in testing ditch and backfill compaction to allow a deeper test to be made by using the sand-core method and/or nuclear testing gauges.

3. HANDLING AND STORAGE OF MATERIALS

- a. The contractor shall be responsible for the shipping and storing of all reuse materials. The contractor shall replace any material that is damaged or defective.
- b. The loading and unloading of all pipe, valves, and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- c. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project. Pipe may not be prestrung along job site; it must be delivered to and removed from job site each day. In extenuating circumstances when the inspector authorizes pipe to remain on the project from one day to the next, the ends of the pipe must be sealed.
- d. All materials, once on the job site, shall be stored in accordance with the manufacturer's recommendations.
- e. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for reuse mains shall be repaired in a manner approved by the City.
- f. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

4. BARRICADES, SIGNS AND STREET PROVISIONS

- a. Signs, barricades, warning lights, guard rails, and flaggers shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall hold the City harmless for any damages or injuries caused by the construction of reuse mains.
- b. Detours and all traffic control measures shall be setup and maintained by the contractor under the direction of the City of Raleigh Department of Transportation and the North Carolina Department of Transportation. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights, and other safety devices to protect his/her construction. The contractor is in no way relieved of liability for providing this protection because others approve the detour.
- c. Construction work zone signs and signing procedures shall conform to the Manual of Uniform Traffic Control Devices (MUTCD) and supplements and to all applicable federal, state and local codes. The contractor shall be responsible for securing the necessary permits from the City's and the State's Department of Transportation and Inspections for all work to be performed in the public rights-of-way.

5. PROPERTY PROTECTION

Trees, fences, poles, and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the contractor to the owner's satisfaction.

6. GENERAL CONSTRUCTION SAFETY

- a. The contractor and any subcontractors shall be responsible for the total compliance with all federal, state, and local ordinances, laws and regulations as related to safe construction practices, and to protecting the employees and the public's health and safety.
- b. The contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for the contractor's adherence to OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.
- d. The contractor shall be required to furnish safety equipment necessary to inspect the work including, but not limited to, ladders, gas detectors/oxygen sensors, blowers, etc.

7. ENCROACHMENT CONTRACTS AND PERMITS

- a. Prior to actual construction, the contractor shall acquire the necessary encroachments from North Carolina Department of Transportation when working within the rights-of-way of state system roads or highways. The encroachment permit shall be kept on the job site at all times.
- b. The contractor shall be responsible for securing all other local, state, and federal permits required for the utility construction.
- c. The contractor must have an approved set of permitted construction plans onsite at all times.

8. PAVEMENT REMOVAL AND REPLACEMENT

- a. All pavements to be removed shall be cut along straight lines with the appropriate saw cut machine. The removal and replacement of the pavement shall conform to the information shown in Details W-1 & W-2.
- b. All cuts of City streets must be patched the same day with a temporary or permanent patch. Once work has been completed, all temporary patches shall be replaced with permanent ones. All work from patching shall be cleaned up at the same time of patching.
- c. The City of Raleigh shall perform density tests as needed to determine contractor's compactive efforts. See Note 2 and 3 of detail W-2.
- d. Pavement cuts shall be confined to a maximum trench bottom width as shown in Details W-1 thru W-3, plus six inches on either side.
- e. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- f. Pavement cuts within NCDOT Right of Way shall not be performed without the proper encroachment permits on site. All patching of NCDOT pavements shall conform to the approved on site encroachment permit.

9. VALVE OPERATIONS

- a. No valve in the existing system shall be operated without following the procedure outlined below. Failure to comply with these requirements shall be grounds for suspension of pipe-laying operations until written assurance can be obtained from a company official that such noncompliance will not occur again. The contractor should be aware that the City regards violations of these requirements as justifying punitive measures.
- b. Notification procedures are as follows:

- 1) The contractor shall notify the Public Utilities Department's Reuse Division at (919) 662-5700 in order to request the operation of any valves. At least twenty-four hours notice must be given to the Public Utilities Department, and at least twenty-four hours notice must be given to each customer affected by a reuse or potable water cut-off. The contractor is responsible for notifying the affected customers. All valve operations shall be done by a Public Utilities Department personnel or by the City's inspector for a particular project. It is illegal for anyone other than a City of Raleigh employee to operate existing potable water or reuse main valve, unless accompanied by a City of Raleigh employee.
- 2) The contractor shall provide the following information when calling the Reuse Division for valve operation:
 - a) Name of person calling
 - b) Name of company
 - c) Telephone number of company
 - d) Location of valve and map number, if available
 - e) Reason for requesting operating and whether to be closed or open
 - f) Time valve to be opened or closed
 - g) Approximate time potable water or reuse line to be out of service
- c. Each time a contractor needs a valve operated, he/she shall again secure permission, following the steps outlined above.
- d. System valves shall be defined as any valve that has main pressure against either gate face. Newly installed tapping valves and control valves to networks not yet accepted for service are considered system valves. Valves within a network still under construction are not considered as system valves.

10. CONSTRUCTION WATER

The City of Raleigh Public Utilities Department does not provide free or otherwise unmetered construction water for any construction project. Hydrant meters may only be moved with the express written permission of the Public Utilities Department. In residential areas hydrant meters may only be used for the filling of swimming pools unless prior approval of the Public Utilities Department. Contractors are responsible for adequate construction water for their job sites in one of the following approved manners:

- a. Apply for permanent water service connection at the Inspections Department Permit Office, 4th floor, Raleigh Municipal Building, 222 West Hargett Street, (890-3450). Sufficient lead-time (6 weeks) should be provided for all new service taps and all fees must be paid in full prior to the work order being authorized.

- b. Apply in person with the Public Utilities Meters Division Office, 3304 Lake Woodard Drive, for rental of a hydrant meter. There are a limited number of these meters and they are reserved in advance by contacting the Meters Division (250-2797). A deposit is required along with a per month rental fee per account plus the cost of the water used, at the outside City rate. Hydrant meters are read in 100 cubic feet (ccf). There is a minimum rental fee and an administration fee for billing and closing an account. A service charge is charged when accounts are closed. Customers are responsible for notifying the Meters Division if the meter is not registering usage. The following information is required:
- (1) Meter location;
 - (10) Billing address, telephone number, responsible party name, and federal tax id#
 - (11) Location of hydrant;
 - (12) Water to be used for;
 - (13) Duration of use and frequency of meter reading,
 - (6) Meters must be brought to the Utilities Operations Center for monthly reading.
- c. Upon application approval, the City shall install hydrant meters and approved backflow prevention devices on the fire hydrant requested by the customer, but acceptable to the City, within three (3) business days of the application and deposit being received.
- d. Hydrant meters accounts are billed monthly. Failure to report usage in timely manner for billing or accounts that are not paid in full will result in the loss of water service and the closing of the account with the City.
- e. Hydrant meters will only be set when the temperature is over 35 degrees. Damage to meters from the cold weather or abuse will be charged to the customers.
- f. Hydrant meters used for long term use shall be returned at the end of every one year block for inspection.
- g. Upon completion of hydrant usage, deposits shall be refunded to customers within 30 days provided the following has occurred:
- 1. Hydrant meter and backflow device have been returned in good condition, with no excessive wear nor damage.
 - 2. All outstanding water usage charges and rental charges for the meter and backflow device have been paid in full by the customer.
- h. The cut off to apply for new accounts is 3:00 PM each business day.

- i. It is a violation of the City Code to establish a direct connection to a fire hydrant to fill a tank or tank vehicle. It is also illegal to use a RP or Double detector check valve on a domestic or fireline service for temporary water service. Violations of the City Code will result in loss of service, fines, and other measures as specified by the Code.
- j. Continued use of a hydrant meter, when usage readings are not being registered is considered theft of City water and subject to civil penalties of \$500.00/day. It is the responsibility of the customer to notify the Meters Division at 250-2737 when the meter is not registering/recording the water usage properly.
- k. Hydrant meters and backflow assemblies approved for use in this program is the property of the City of Raleigh Public Utilities Department. Failure to return the hydrant meter and backflow preventer at the end of the rental period will be considered theft of City property and prosecuted to the fullest extent of the law.

Note: Individuals caught using water unmetered and/or unauthorized by the Public Utilities Department will be prosecuted to the fullest extent of the law.

11. EXCAVATION

- a. Prior to any excavation or construction, the contractor shall locate all existing utilities in the field. If help is needed in locating utilities operated by the Public Utilities Department, the contractor should contact the Operations Division at (919) 250-2737.
- b. Trench width shall be a minimum of six inches plus outside diameter of pipe and a maximum of twenty-four inches plus outside diameter of pipe, unless OSHA requires additional trench width. Trench width shall be measured between the faces of the cut at the top elevation of the pipe bell as shown in Standard Water Detail W-3.
- c. Trench bottom conformation, where no special bedding is required, may be that referred to herein as flat bottom where the trench bottom is excavated slightly above grade and cut down to pipe grade by hand in the fine-grading operation. Where the trench bottom is inadvertently cut below grade, it shall be filled to grade with an approved material and thoroughly tamped compacted to 95% or use #67 stone to bring to grade.
- d. The maximum length of open trench shall be no more than three hundred feet, unless approval is obtained from the Public Utilities Director.
- e. The contractor shall, at his/her own expense, keep all trenches free from water during the excavation for construction of foundations, masonry, and reuse mains. The water shall be pumped out of the trench or build check dams to keep it out of the ditch in such a manner as not to cause injury to the public health, private property, or the work in progress. Erosion control measures shall be taken during this pumping.

- f. In trenches where water is present or dewatering is required, the trench shall be stabilized with #67 stone. When the contractor encounters material during trench excavation, at the opinion of the inspector or Public Utilities Director, that is unsuitable (i.e. "muck"), this material shall be replaced with material that is considered suitable prior to the pipe-laying operations. In this case, construction fabrics may be required to prevent the migration of side support away from the pipe.
- g. Safety and convenience of the public necessitate that all work, including excavation, be done in such a manner as to cause minimum traffic interruption, both pedestrian and vehicular. Utilities such as fire hydrants, valves, etc., shall be accessible at all times. Gutters and drains shall be left open and clear at all times, and the contractor shall be responsible for all drainage around his work. Unless specifically waived by the Transportation Director, provisions shall be made to maintain vehicular traffic on all streets in which work is in progress, and suitable walkways shall be maintained for pedestrian travel.
- h. Sheet piling or bracing shall be used wherever necessary to prevent failure of the trench banks. All sheet piling shall conform to AASHTO and OSHA safety standards. The decision of the Public Utilities Director or Engineer relative to bracing for the protection of property of the City shall be binding upon the contractor. The removal of sheet piling shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls.

12. ROCK EXCAVATION

- a. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Public Utilities Director or Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding $\frac{1}{2}$ cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. All blasting shall be done under the supervision of the City Inspector or Engineer and subject to all applicable regulations. The City reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close to or so situated with respect to the blasting as to make blasting hazardous. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor.
- b. Blasting procedures shall conform to all applicable local, state and federal laws and ordinances. A blasting permit shall be obtained from the City of Raleigh Fire Marshal's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshal may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden.

The contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five-hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.

- 1) Date of shot
- 2) Time of shot
- 3) Crew Supervisor
- 4) Number and depth of holes
- 5) Approximate depth of overburden
- 6) Amount and type of explosive used in each hole
- 7) Type of caps used (instant or delay)
- 8) The weather
- 9) Seismograph instrument and readings

- c. This blasting log shall be made available to the Public Utilities Director or Engineer upon request and shall be kept in an orderly manner. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to hold the City of Raleigh harmless from any claims.

13. TRENCH PREPARATION

- a. Trench excavation shall conform to the line and depth shown on the plans. The trench shall be properly braced and drained so that workers may work therein safely and efficiently. When water is being pumped from the trench, the pump discharge shall follow natural drainage channels, drains or storm sewers. In discharging trench water, it will be necessary to follow standard erosion control measures so as to minimize erosion and sedimentation. In no case may trench water or groundwater be pumped into or allowed to enter the sanitary sewer system.
- b. The width of the trench may vary with the depth of cut and other conditions the trench shall be in accordance with the dimensions set forth by OSHA and other information shown on Standard Water Detail W-3.
- c. The foundations for ductile iron shall be a firm and stable flat bottom (Type 1) trench with bell holes so that the pipe rests uniformly on the entire barrel length. See Standard Water Detail W-3.
- d. Pipe clearance in rock shall be a minimum of six inches below and on each side of the pipe for sized sixteen inches and less in diameter. For sizes larger than sixteen inches in diameter, the minimum clearance shall be nine inches below and on each side.

14. PIPE INSTALLATION

- a. Ductile iron pipe shall be installed in accordance with the requirements of the latest AWWA Standard C-600-87.
- b. Reuse pipe shall be laid to the line and grade shown on the plans with all valves and hydrants located as shown on the plans.
- c. Protection shall be afforded to all underground and surface structures using methods acceptable to the Public Utilities Director or Engineer. This protection shall be furnished by the contractor at the contractors' own expense.
- d. Deviation from line and grade may be made only on revised plans upon approval by Public Utilities Department and identified on "as built" when such deviations arise from grade or line conflicts with existing utilities, structures or other sources of conflict.
- e. Subsurface explorations shall be made by the contractor at the direction of the Public Utilities Director or Engineer where it is necessary to determine the location of existing pipes, valves or other underground structures.
- f. Depth of pipe cover, unless shown otherwise on the plans shall be three feet. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the barrel of the pipe.
- g. After the foundation has been properly graded, bedded when applicable, and the bell holes dug, the pipe and accessories shall be carefully lowered into the trench by approved methods. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. All damaged pipe and accessories shall be removed from the job.
- h. Pipe shall be swabbed clean with sodium hypochlorite solution before it is laid, and any pipe which cannot be cleaned with a swab shall be removed and cleaned with suitable apparatus. Any pipe showing evidence of oil, tar or grease shall be permanently marked and removed from the job.
- i. Laying of pipe and jointing of pipe shall be done according to manufacturer's recommendation with care being taken to provide uniform bearing for the pipe. Bell and spigot of pipe shall be cleaned and properly lubricated where a mechanical joint of a "push on" type joint is employed. No chlorine powder or tablets shall be put in the lines during installation.
- j. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.

- k. Pipe cutting for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner in accordance with the manufacturer's recommendations and without damage to the pipe.
- l. Bell ends will face the direction of laying unless otherwise directed by the Public Utilities Director or Engineer. For lines on an appreciable slope, the Public Utilities Director or Engineer may also require that bell ends face upgrade.
- m. Maximum horizontal deflections for ductile iron pipe shall be as follows for an eighteen foot joint of pipe:

MAXIMUM DEFLECTION IN INCHES

<u>Size Pipe</u>	<u>MJ</u>	<u>Push-on-Joint</u>
4	31	19
6	27	19
8	20	19
10	20	19
12	20	19
14	13	11
16	13	11
18	11	11
20	11	11
24	9	11
30	9	11
36	8	11
42	7	7
48	7	7

- n. When installing a reuse main, a 10-foot horizontal separation shall be maintained between reuse and water mains. If this separation cannot be maintained due to existing conditions, the only variation allowed is the reuse main in a separate trench with the elevation of the reuse main at least 18 inches above the top of the sewer main or below the top of the water main; this exception must be approved by the Public Utilities Director. All distances are measured from outside diameter to outside diameter.
- o. When a reuse main crosses a sewer and/or water main, there must be eighteen inches of vertical separation. Where practical, water, reuse, and sewer mains shall be located in order of descending quality from the ground surface. If the reuse main must go over the water main, or if the reuse main must go under the sewer main, both these lines must be of ductile iron for a distance of ten feet on either side of the crossing with a twelve-inch vertical separation. The crossing of other underground pipe requires a minimum of twelve inches of vertical separation. Any changes in these clearances must be approved by the Public Utilities Director. All crossings within these vertical clearances shall be filled with #67 stone. All distances are measured from outside diameter to outside diameter.

- p. When a reuse line passes over or under a storm sewer, vertical separation of 18 inches shall be maintained unless both lines are of ductile iron or encased in concrete. A concrete pad shall be poured between the two. Distances are measured from outside diameter to outside diameter.
- q. Railroad crossings shall be made following all precautionary construction measures required by the railroad officials.
- r. All reuse crossings under the state system roads shall be made in accordance with the requirements of the NC DOT as defined in their encroachment permits.
- s. Where conditions are, in the opinion of the City Inspector, unsuitable for laying pipe because of weather or trench conditions, the contractor shall be required to cease work until permission is given by the City Inspector for work to commence again, providing such conditions have been corrected.
- t. All reuse piping, valves, outlets and other appurtenances shall be color-coded, taped, or otherwise marked to identify the source of the water as being reuse water, as described in the Reuse Materials Section of these specifications.

15. REACTION BLOCKING

- a. All fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place, unless otherwise directed by the engineer. The reaction areas required for these thrust blocks shall be given to the contractor by the inspector, and the contractor shall install the blocks according to directions provided by the inspector. Where concrete must be reinforced, the contractor shall furnish such reinforcing as is required.
- b. Required reaction bearing areas will be taken from the schedule herein. See Standard Water Details W-10 & W-11. Areas given are vertical plans measured in solid material normal to the thrust line of the fitting.
- c. Material for reaction blocking shall be transit-mixed concrete. This concrete shall have a minimum twenty-eight day compressive strength of 2500 psi. Any metal used to resist thrust that is not encased in concrete shall be galvanized or otherwise treated for corrosion resistance or shall be painted as directed by the engineer.
- d. Valves on ductile iron lines shall be anchored with thrust collars as shown in Standard Water Details W-7 through W-9.

16. BACKFILLING PIPE

- a. The backfilling of the trench after the pipe installation and testing shall be in accordance with Standard Water Details W-3 for ductile iron.
- b. Ductile iron pipe shall be backfilled with suitable native material. No rocks, boulders, or stone four inches or larger shall be included in the backfill for at least two feet above the top of the pipe.
- c. All backfill shall be compacted in six-inch lifts measured from the pipe foundation upward. Backfill for roadway shall be compacted to at least 95% of maximum soil density in those areas where the supporting capacity of the soil is of prime consideration. Laboratory determination of maximum soil density will follow the procedure of AASHTO T99-86. Field determination of the density of the soil in place shall follow the procedure of AASHTO T191-86 or T204-86. The result of any one test may be a minimum of 90% of maximum density, but the average of any three tests in an area shall be 95% of maximum density. All tests shall be conducted at the direction of the City Inspector, and the cost of such tests will be borne by the contractor with the provision that the City will test an area two times only where both tests fail. The contractor shall then be required to submit satisfactory evidence that his ditch compaction meets the specifications.
- d. Deficiency of backfill material shall be supplied by the contractor where this deficiency results from any cause other than rejection of unsuitable backfill material (other than rock) by the City Inspector. In cases where the City Inspector directs, the contractor shall dispose of unsuitable backfill material and provide suitable backfill material.

Where excavated material has been rendered unsuitable, either before or after excavation, by inclement weather or type of material, the contractor must correct the moisture or furnish replacement backfill material.

- e. Backfilling shall not be allowed, except with permission of the City Inspector. When a ditch is flooded or the weather is unsuitable, the contractor shall not backfill unless permission is given by the City Inspector. No backfilling with frozen material shall be allowed.

17. SETTING VALVES AND VALVE BOXES

- a. Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement is existing, the box shall be adjusted to finished street grade as shown in Standard Water Detail W-17. When valves are located in street rights-of-way, but out of pavement, the boxes shall be adjusted to finished grade and a concrete pad two-feet square and six-inches thick shall be poured around the box one-half inch from the top. When valves are located outside of street rights-of-way, the boxes shall be at finish grade, and a concrete block two-feet square and

six-inches thick shall be poured around the box at grade line. Valve locations out of street rights-of-way shall be marked with a metal post having a minimum diameter of two inches and a minimum bury of three feet with a minimum of three feet exposed. The exposed portion shall be painted purple and shall be placed so that a valve operating tool has free operation.

- b. When a tapping sleeve and valve are being used, the valve, sleeve, and machine assembly shall be air tested to hold at 150 psi for a five-minute duration in the presence of the inspector prior to drilling or tapping the main. The valve shall be in the closed position during the testing.

18. SETTING FITTINGS

Fittings shall be set at locations shown on the plans with care being taken to properly "bell-up" joints and support the body of the fitting. All dead-end lines shall be plugged with mechanical joint plugs or caps and anchored by using thrust collars and blocking as shown on Standard Water Details W-7 and W-8.

19. SETTING BLOW-OFFS AND RELEASE VALVES

- a. Blow-offs and drainage branches shall not be submerged in any stream or be installed in any other manner that will permit back siphonage into the distribution system.
- b. All blow-offs shall be installed as shown on Standard Reuse Details R-1 and R-2 to divert flow to the sewer collection system. Blow-offs shall not be installed to allow drainage to any area other than a sewer manhole.

20. SURFACE RESTORATION

- a. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters, or sidewalks until the contractor repaves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut. Asphalt compaction shall be done with a gasoline or diesel powered smooth drum asphaltic roller.
- b. All easements will be seeded with grass and left so they can be mowed by conventional mowers, unless approved by the Public Utilities Department for rip-rap or other specified material. In remote areas, easements will be seeded with a quality fescue grass. In residential areas, easements will be seeded with either falcon or rebel fescue or leaf mulch at the request of property owner. The contractor shall guarantee a good uniform stand of grass and shall reseed any bare or thin spots. The contractor will be responsible for a one-year warranty on materials and workmanship.

21. EROSION CONTROL

Erosion control measures shall be performed by the contractor, conforming to the requirements of, and in accordance with, plans approved by the State of North Carolina Department of Environment and Natural Resources, North Carolina Sedimentation Control Commission, and City of Raleigh Inspections Department Erosion Control Division, and as per the erosion control plan portion of the construction drawings and these specifications. The sedimentation and erosion control plan and permit shall remain onsite at all times. The contractor shall not allow mud and debris to accumulate in the streets. Should the contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to the entry into any storm drain or stream. All measures must be taken so that stormwater runoff does not go to the pipes or manholes of the utility system. All materials used for erosion control shall be approved by the Engineer prior to installation by the contractor.

- a. Temporary and permanent erosion control measures shall be shown on the plans. Temporary and permanent erosion control work shall be coordinated throughout the project to provide effective and continuous erosion control throughout construction and post construction, which minimizes siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property. Seeding and mulching shall be carried out immediately behind construction.
- b. Temporary erosion control measures shall include, but not be limited to, swaled easements, silt fences, crushed stone check dam devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.
- c. Permanent erosion control measures shall include, but not be limited to, swaled easements, rip rap, and seeding of disturbed areas.
- d. Erosion and siltation shall be controlled on projects by using swales to control run-off and convey run-off to controlled discharge points, by silt fences, rip-rap, crushed stone, and earth berms to contain silt, with pipe culverts where major access or haul roads cross drainage ditches or streams, silt basins where pipe lines cross drainage ditches or streams, and seeding and mulching will be performed as soon after pipe installation as possible. When temporary measures are removed after completion of the project the disturbed area must be stabilized, if necessary.

22. MAINTAINING SERVICE

When replacing or extending reuse mains, the contractor shall maintain existing reuse services.

23. GUARANTEE

The contractor shall guarantee all material, equipment, and workmanship for a period of at least one year after final acceptance by the City. The Public Works

Departments Construction Inspection Division is responsible for the issuance of final acceptance letters by the City.

24. WETLAND/STREAM BUFFERS

Conditions of 401/404 permits shall be strictly followed to the satisfaction of Corps of Engineers. All Neuse Riparian buffers shall be maintained as required by the North Carolina Division of Water Quality.

25. GENERAL REUSE MAIN TESTING SEQUENCE

Reuse mains shall be tested in the following general sequence:

- a. "Pigging" main (mains with gate valves)
- b. Flush the main (flush water shall be routed to the sanitary sewer system)
- c. Perform the hydrostatic tests
- d. Introduce the appropriate amount of chlorine by tapping the main
- e. Hold the chlorine solution in the main for at least twenty-four hours and no more than seventy-two hours
- f. Flush the main (flush water shall be routed to the sanitary sewer system)
- g. Sample for the bacteriological tests
- h. Water mains shall be placed into service within 48 hours of meeting bacteriological analysis requirements. If no activity is anticipated on a reuse main for the first 30 days after it is placed into service, the contractor shall notify the City of Raleigh Public Utilities Department at 870-2870.

26. PIGGING

All new mains with gate valves must be pigged with a polyethylene "pig", 5#/cubic foot density, at the conclusion of installation.

The pig must be blown at the end of the main by means of the following:

- a. 4" main - 4" blow-off
- b. 6" main - 6" blow-off
- c. 8" and 12" main - blow-off assembly as shown on Standard Water Details W-21 & W-22
- d. 16" – 24" main - temporary pig retrieving station as approved on plans

The contractor installing the line shall write the name of the company and street name in which the work is taking place on the pig in a manner in which it will not rub off.

27. HYDROSTATIC TESTS

- a. All main installations, including private distribution lines to the buildings, shall be pressure tested between each main line valve in accordance with the latest AWWA Standard C-600-87. The test shall be performed using a suitable pump and an accurate pressure gauge. Immediately upon completion of a section of main, 150 psi (\pm 5 psi) of pressure shall be applied and held for two hours. The acceptable leakage rate shall not exceed 0.092 gallons per inch of pipe diameter per 1,000 feet of pipe per hour.

Failure of the reuse main to comply with the above acceptable leakage rate shall require the contractor to replace any defective materials to insure a watertight installation. If it is deemed that the existing blowoff valve is the cause of failure, the party responsible for the water main extension shall also be responsible for adding a valve at that location and abandoning the existing valve. After any inadequacies have been corrected, the leakage rate will again be tested. This test shall be repeated until that portion of main is brought to compliance with the permissible leakage rate.

- b. Prerequisite conditions for inspection prior to testing shall be as follows:
 - 1) Valves shall be properly located, operable, and at correct elevation. Valve boxes or manholes shall be centered over operating nuts, and the top of the box or manhole shall be at proper elevation.
 - 2) Lines shall be properly vented where entrapped air is a consideration.

28. CHLORINATION

- a. All additions or replacements to the reuse system, including backflow prevention devices, shall be chlorinated before being placed in service. Such chlorination must take place under the supervision of an inspector.
- b. Pipe subjected to contaminating materials shall be treated as directed by the Public Utilities Department or Engineer. Should such treatment fail to cleanse the pipe, replacement shall be required. The City shall bear no portion of any cost sustained by the contractor in meeting this specification.
- c. Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.
 - 1) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These taps shall be located in such a manner as to allow HTH solution to be fed into all parts of the line.

- 2) A solution of potable water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The table below shows the required quantity of 70% HTH compound to be contained in solution in each 1000-foot section of line to produce the desired concentration of 50 ppm.

<u>Pipe Size</u>	<u>Pounds High Test Hypochlorite (70%) Per 1000 Feet of Line</u>
4"	0.40
6"	0.88
8"	1.56
10"	2.42
12"	3.50
14"	4.76
16"	6.22
20"	9.76
24"	14.00
30"	21.00
36"	31.50
48"	56.00

- 3) The HTH solution shall be circulated in the main opening the control valve and systematically manipulating taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains.
- 4) Services shall be sterilized by methods acceptable to the Public Utilities Director or Engineer, and the contractor shall have the same responsibility for laterals as for mains in regard to bearing full cost of any corrective measures needed to comply with bacteriological or other requirements.
- 5) HTH solution shall remain in lines for no less than twenty-four hours, unless otherwise directed by the Public Utilities Director or Engineer.
- 6) Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.

29. BACTERIOLOGICAL SAMPLING

- a. Free residual chlorine after twenty-four hours shall be at least 10 ppm, or the Public Utilities Department or Engineer will require that the lines be rechlorinated.

- b. Mains will be flushed with potable water with a blow-off assembly of sufficient size to effectively clean the main. See Standard Water Detail W-22. The flushing connection shall include cross connection control measures, including an appropriately sized reduced pressure principle backflow preventer, and shall be approved by the Public Utilities Department. In cases where a connection to the potable water system is not practical and flushing with reuse water is proposed, written authorization from the Public Utilities Department will be required prior to proceeding with flushing operations. The party making the written request to flush with reuse shall prepare a flushing plan for review and approval by the Public Utilities Department. . Flushing of lines may proceed after twenty-four hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until chlorine returns to normal level. During times of water shortages or distribution main problems, the flushing operation may be delayed. The Public Utilities Department shall determine when flushing is allowable. The contractor shall advise the inspector prior to the chlorination and flushing so that the inspector can advise the Public Utilities Department of the construction location, size, and length of mains. All tests will be done in the presence of an inspector. Flushing will be for short duration. Sufficient precautions must be taken to the satisfaction of the inspector to ensure that the impact of the water is absorbed and the water is conveyed without erosion or property drainage. All flush water shall be dechlorinated using methods acceptable to the City of Raleigh Public Utilities Department.
- c. After flushing is completed, the Public Works Department (or their designee) shall collect samples for turbidity and bacteriological analysis for each section of pipe between main line valves. A custody seal shall be placed on each set of turbidity and bacteriological bottles. A chain of custody form must be completed for sample set(s) collected and must be delivered along with the sample(s). A turbidity test will be done. If the turbidity exceeds 1 NTU, the sample fails and a bacteriological test will not be set up. The Public Utilities Department will perform the turbidity and bacteriological analysis.
- d. Samples will be accepted between 8:00 AM and 12 NOON and 1 PM and 3:30 PM Monday through Thursday, excluding holidays. Special arrangements may be made for samples to be accepted outside of this time frame by calling the laboratory in advance.
- e. In the event that two successive bacteriologic tests fail, that section of the main shall be rechlorinated by the contractor and new tests performed prior to moving to the next section of main.

30. SERVICE CONNECTIONS

- a. Taps shall be made only on a line under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization from the engineer is obtained.

- b. Taps shall be at an angle of forty-five degrees to a perpendicular plane through the center line of the pipe as shown is in Standard Water Detail W-23.
- c. The maximum size of direct taps shall be as follows:

<u>Main Size</u>	<u>Maximum Tap Size</u>
4"	3/4"
6"	1"
8"	1 1/4"
10"	1 1/2"
12" and larger	2"

On 4-inch through 10-inch mains, larger size taps may be made by using a service saddle.

- d. Services larger than two inches shall be made by using a tapping sleeve and valve. The service line from the main shall be:

4-inch D.I. for 4-inch services;
6-inch D.I. for 6-inch services; and
8-inch D.I. for 8-inch services.

The typical tapping sleeve and valve is shown in Standard Water Detail W-14.

- e. No taps or services shall be made on the 24-inch or larger transmission mains.
- f. Before any reuse services are installed, the main shall be thoroughly flushed using a flow velocity sufficient to scour the pipe interior. All flush water originating from a reuse main or other reuse water source shall be discharged to the sanitary sewer system.
- g. Each meter yoke shall be flushed before the installation crew proceeds to the next service installation.

REUSE MAIN AND SERVICE ABANDONMENT

Reuse services to be abandoned must remove the corporation cock and insert a plug in the main. When plugging the line is not available, the corporation cock may be turned off, capped, and surrounded with 1 ft³ of concrete. All remaining portions of the service shall be removed from the main to the right of way line and shall be disposed of properly. Water main abandonment must be performed in accordance with a plan approved by the Public Utilities Department. Service and

main abandonment require inspection by the Public Works Department at 890-3030.

SEALED AS BUILT PLANS

Certified surveyed "As built" plans and profiles, sealed by a Professional Land Surveyor, shall be furnished to the Public Works Department by the Engineer upon completion and acceptance of the reuse main by the City and completion of private systems. The surveyed "as built" plans shall have North Carolina Geodetic Survey grid coordinates to all meter boxes, valves, manholes, and mains along with the depth information. The reuse permit number information must also be included. Surveyed "As built" plans of installed utilities shall be furnished to the City prior to issuance of the letter of acceptance. All service stubs shall be shown on the surveyed "as built" plans.

Certified surveyed "As Builts" should be provided in a digital format. The digital file of utilities needs to show the overall water, reuse, and sewer system layout along with the property or subdivision boundaries and connecting manhole. The reuse distribution system drawings should show mains sizes, material, valves, blow-off assemblies, and any other relevant information (backflow preventers, air release valves, etc.). The digital file should be delivered in DXF format. If this is not possible, then, DWG, DGN, and SHP are also acceptable formats.

GENERAL ACCEPTANCE

The developer or his representative must notify the Public Works Departments' Engineering Inspector, in writing, before installation and for scheduling inspection. Once the project is complete a punch list and inspection is scheduled noting any deficient items. Once the deficient items are repaired and/or replaced to meet City standards and specifications the developer or his/her representative shall submit the following items to the City's Public Works Department.

- a. A professional engineer's certified statement of the cost of the public utilities installed.
- b. A professional engineer's certified statement indicating that the work has been built in accordance with the approved set of construction plans.
- c. A release of liens statement from the owner/developer stating that all materials and workmanship associated with the reuse main has been paid in full.
- d. "As-Built" plans and profile shall be furnished by the engineer upon completion and acceptance by the City as stated above.
- e. The developer is responsible for ensuring a one-year written warranty to the City prior to issuance of the letter of acceptance.

- f. The developer and/or engineer shall provide a recorded map to the City of Raleigh showing all public rights-of-way and easements.
- g. The engineer shall keep a copy of the “as built” plans on file indefinitely.